Editorial

LAST month I made some comment on the installation of television stations in Australia, urging that careful consideration be given to their siting to ensure the greatest possible coverage for programmes.

During the last few weeks I have travelled about 2000 miles through New South Wales to the North, the West, and the South, listening as I went to the various radio programmes by means of a car radio.

I was greatly impressed, as must be others who have covered similar ground, by the reliance placed by people in country towns, and in more isolated communities, on radio entertainment. It wouldn't be too much to say that radio has done more to reconcile country people to their ever present feeling of isolation than any other single thing.

The spread of AC power lines throughout the land has brought them radio comparable with the standard enjoyed by others living in more closely settled areas. A big proportion of them have now a choice of programmes, and their radiograms are able to play gramophone records of any speed just as easily and as well as people in the city.

It is hard to pass through numerous progressive and large country towns without feeling that when we have television, it must come to the country without delay. Looking into the future, knowing the high cost and technical problems involved in large scale distribution, one feels, nevertheless, that any scheme which does not include as part and parcel immediate attention to the needs of country people will be inadequate.

I am beginning seriously to doubt the wisdom of any suggestion that television should initially be organised on an experimental basis in one or two cities, or on a firm programme confined to the seaboard capitals.

It is probable that the first step will be something on these lines because the origination of television programmes must be secured before any service can start. But we cannot halt there, leaving a fuller coverage plan to beconsidered when we get around to it.

Our problem in Australia is probably unique, as it has been in broadcasting because of our wide spaces and scattered population. It is one reason why we have such a large number of radio stations to cover 8-million or so people, probably more per head than any other country in the world.

Surely we must from the start appreciate that television has presented us with the same type of problem, intensified by the need for new methods of attack in bringing programmes to all. One thing seems certain—we cannot avoid realising that we have the same obligation to the country as we have in respect of broadcasting.

But this is nothing new to the realist's approach to television. It is far too big for us to play with. If we start, it must be all or nothing.

John Moyle

INDEX

Page
Same Pattern The World Over 3
3D Or Not 3D? 4
French Electronic Telescope .. 9
First Turbo-Prop Lightplane .. 11
Let's All Be Anthropologists .. 12
Technical Review 15
News And Views 21
Battery Powered "Playmaster" .. 24
The Serviceman Who Tells 33
Recent Transistor Research .. 36
A Reader Built It 45
Here's Your Answer Tom 46

Page
A Two-Valve Reaction Set 48
Survey Of Radar Techniques .. 57
Simple 3-Band Oscillator 60
Installing Your New "Karset" .. 67
Let's Buy An Argument 72
Trade Reviews And Releases .. 77
Off The Record 82
Short-Wave Notes 84
The Ham Bands 85
An Easily-Made Hygroscope .. 91
Answers To Correspondents .. 94

RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

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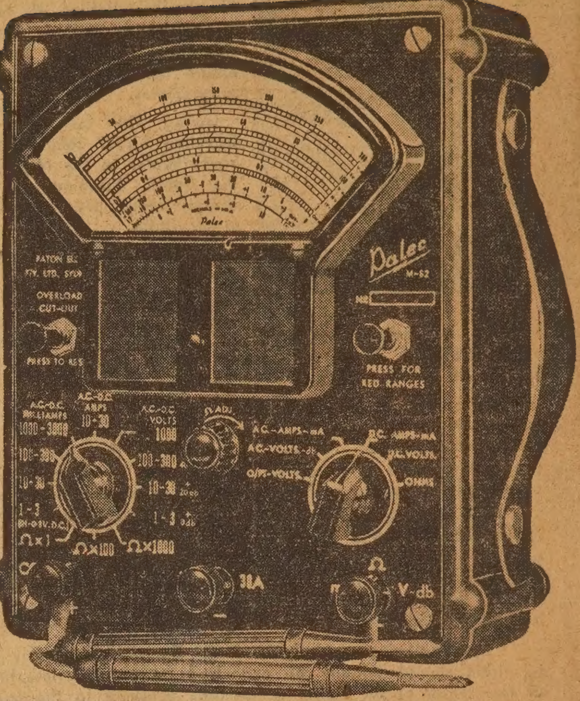

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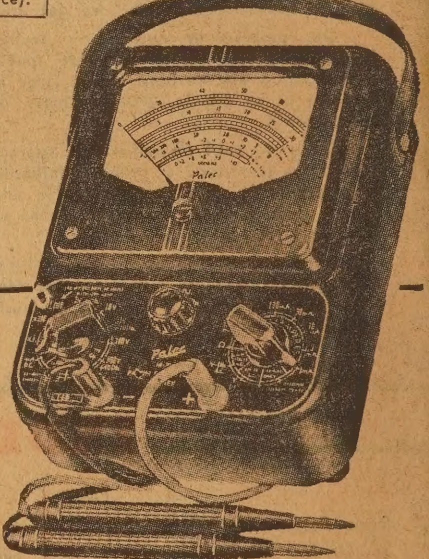

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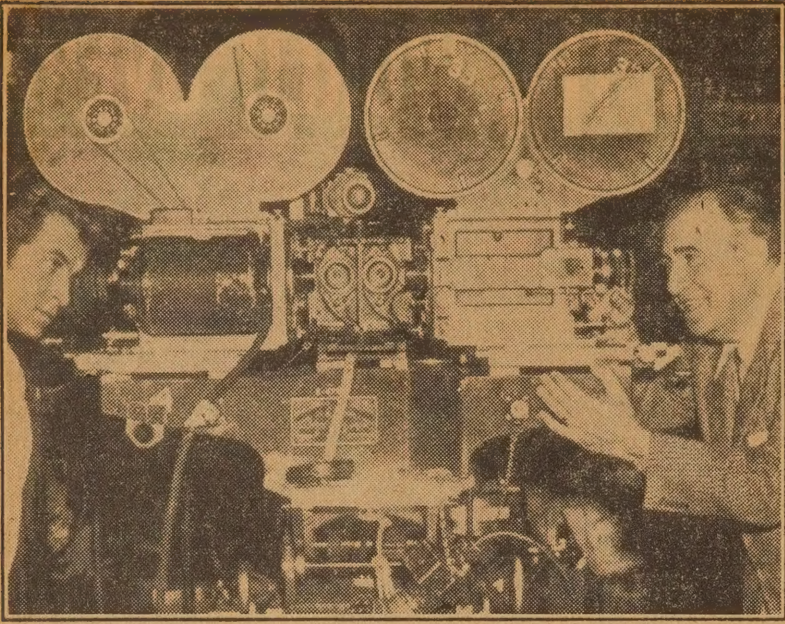
SAME PATTERN THE WORLD OVER

AUSTRALIAN schoolchildren are familiar with educational broadcasts through national stations. French children have their equivalent "cours d'enseignement primaire". Sponsored by M. Andre Marie, National Minister for Education, the broadcasts are made at 9.15 am each day. (By courtesy of French Embassy.)



Paramount director Edward Ludwig (right) introduces a twin-film 3D camera to actor Fernando Lamas, preparatory to photographing "Sangaree" by the new "Paravision" process.

3D *or not* 3D?

What is the real story behind the "Depthies", "Roundies", "3-D" and similar ballyhoo expressions which are almost daily appearing in overseas Press reports ? Has Hollywood really "got something" which will shake the movie world as did sound, or will the whole thing fizzle out, as have similar ventures before?

BEFORE analysing the technical aspects of the matter, we may as well appreciate the real reason for all this sudden upheaval. It can be explained in one phrase — "TV jitters."

There is little doubt that television is having a tremendous impact on the entertainment routine of the average American citizen and that the motion picture industry is suffering as a result in terms of box office receipts.

TO BEAT TV

The industry is consequently determined that something drastic must be done to keep its product at least one step ahead of this most dangerous competitor. The result is an attempt to bring to practical fruition something which has occupied the minds of inventors for almost as many years as there have been motion pictures, namely, motion pictures in three dimensions.

Unfortunately, the terms "third-dimensional" and "stereoscopic" have been used very loosely in the past. Many publicity writers have been far more interested in sensational statements than technical accuracy, with the result that practically every major optical advance in recent years, from improved depth of focus to color photography, has been credited with producing a third-dimensional effect.

In point of fact, true three-dimensional photography, either still or movie, is nothing new. Indeed it is nearly as old as either of these arts and, as far as still photography is concerned, it has already flourished and died once (in the mid Victorian era) and is now merely staging a comeback.

In Grandpa's day, no well equipped drawing room was considered complete without a stack of sepia toned stereo prints, showing the famous beauty spots of the world, and a hooded viewing device by means of which they were reproduced in all their three-dimensional glory.

This viewing device really represents the crux of the whole problem because, to date, no one has succeeded in producing true three-dimensional pictures, either still or movie, without the need for some form of individual viewing device or, in the case of some special screen systems, severe restrictions on the position which the viewer's hea must occupy.

In order to understand why thi is so, it is only necessary to con sider the technical aspects of three dimensional portrayal and the re quirements which must be fulfille before it is possible.

It is because we have two eye that we are able to appreciate th fact that various objects are at dif fering distances from us. Ther are other factors—like the size c familiar objects—which enable us t judge their distance but, in the mair we rely on our two eyes to giv us the information.

If you doubt this, try going abou your normal daily routine for a fe hours with a patch over one ey and see how awkward you feel.

When we concentrate our gaze o a particular object, two muscula actions take place in the eyes. Th first is the flattening of the eyeba to enable the eye to focus the sub ject sharply. It is the direct equiva lent of the focusing action of camera when we move the lens rela tive to the plate.

The other action, and the one i which we are mainly interested her is the slight movement of the tw eyes toward each other to enabl each to look at the same object.

It is fairly obvious that the close the object is to us the more th eyes must move toward each othe to concentrate upon it. (Remembe the old schoolboy trick of concen trating on an object at arm's lengt and then slowly bringing it to withi a few inches of the face to produc a cross-eyed effect?)

It is the muscular action require to move the eyes closer togethe which the brain interprets as dis tance so that we know, quite sub consciously, that an object whic requires a lot of movement is clos and one requiring less movement further away. In other words, th eye system is a natural range finde and, in fact, mechanical range finde are a copy of it.

CAMERA LIMITATIONS

An ordinary camera has only or lens or "eye" and consequently re produces pictures similar to thos we see if we had only one eye. Fo this very reason many photographe make it a habit to view a prospectiv picture scene with one eye to bet ter appreciate how it will appear a a flat print. (Even a single eye better than a camera because, wit practice, the brain can be taught t interpret the focusing action in term of distance.)

In order to produce a third-dimen sional picture it is necessary to tak

That is the Question...

by Philip Watson

o photographs of the same scene, t from slightly different view ints, the taking lenses being ap- oximately the same distance apart the human eyes (2¼in to 2½in).

If the two resulting prints are now esented to the viewer in such a y that his right eye sees only right-hand picture and his left only the left-hand picture, the o eyes will be called upon to make actly the same muscular adjust- nts as they would if they were wing the original scene.

As a result, the varying distances objects from the camera position n be clearly discerned and the rd dimension becomes a reality.

The third dimension so formed is in any sense an optical illusion, t is just as much a fact as the o dimensions already present in an linary photograph. Just as meas- ements can be made in these two nensions, so, with suitable appar- s, can measurements be made in third dimension and the distance ween objects at varying distances m the camera can be determined h a high degree of accuracy.

ACTICAL USE

Extensive use is now made of this ility in preparing contour maps m stereoscopic pairs exposed in craft where it is quite possible measure accurately the varying ght of the ground which has been otographed from directly above. the present time, large areas of stralia are being surveyed in this y, making possible a tremendous ing in time over the old ground vey systems.

This system was also used during last war and enabled the Allies determine, among other things, depth of water off Pacific island ches, which were at that time d by the enemy. This information vital to the subsequent assault these islands by Allied forces.

n other words, the effect of depth ned by true stereoscopic systems due to the actual portrayal of third dimension, is not dependent any way on the imagination of viewer, and is in no sense an cal illusion.

is also important to emphasise t the third dimension can be duced in no other way and that ystem, no matter what the claims, a true three-dimensional system ess it conforms to the require- nts of presenting right and left d pictures to the right and left s respectively.

n practice there is no great diffi- y in taking either still or movie ures in the form of stereoscopic s, it only being necessary to nge two cameras, side by side suitably coupled, so that their es are the required distance rt. For greater convenience, the separate camera systems may uilt into the one case and given mon view finder, controls, &c.

n the other hand, still pictures be made of landscapes and in- nate objects with a single cam- the two exposures being made after the other and the camera being placed in the correct taking position for each exposure.

The real problem arises when we come to present these two pictures to the viewer in such a way that the right and left eyes see only the right and left pictures respectively.

The earliest method of doing this was suitable for still photography only. It placed a pair of lenses in front of the eyes, which enabled the pictures to be viewed at such close range (about 6in) that it was quite easy for each eye to concentrate on its own picture. This was the system used in the mid-Victorian stereoscopes and is still used in simple viewers for modern color stereo systems.

It is obvious, however, that this system is unsuitable for mass viewing of motion pictures.

The first attempts at mass viewing, therefore, used what has since become known as the "anaglyph" system. In this method the two stereo pictures were superimposed on the one film, but printed in opposing colors (approximately red and blue) and the audience were supplied with viewing spectacles having one red and one blue glass.

The colored glasses served to separate the two images so that each eye saw only the image intended for it and the requirements for true third-dimensional portrayal were thus fulfilled.

CHEAP GLASSES

In spite of the fact that the final picture was a monochrome and that there was considerable light loss due to the color filters, it was capable of producing very startling effects, particularly when the subject was chosen with this requirement in mind. As a novelty it enjoyed considerable popularity and specially selected short subjects have been released from time to time. Some of the first releases were well before the talkie era.

One advantage of the system was that the viewing glasses could be made very cheaply, the frames being made from cardboard and the lenses from dyed celluloid or plastic. As a result these could be issued to the audience gratis and without any worry about reclaiming them after the show.

The desire to present color motion pictures in three dimensions and also the need to improve the light efficiency led to the development of the system which is most popular at the present time, that using polarised light. The phenomena of polarised light had been known for many years, but it was of little practical value until just before the last war when methods were evolved to produce the necessary filters at reasonable cost.

Without going into technical details, which are very complex, it may be stated that light which has been passed through a polarising

A flashlight photograph of a British audience wearing polaroid spectacle: to view a 3-dimensional picture at the Festival of Britain "Telecinema".

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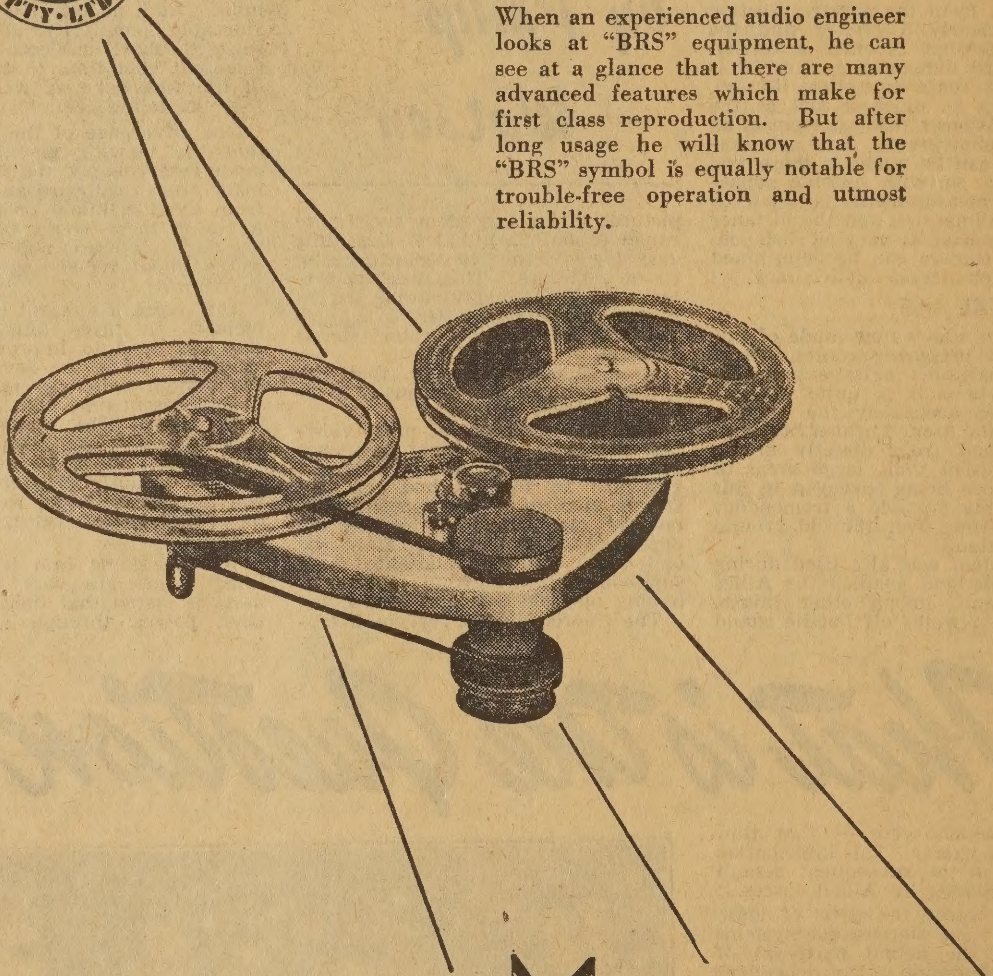

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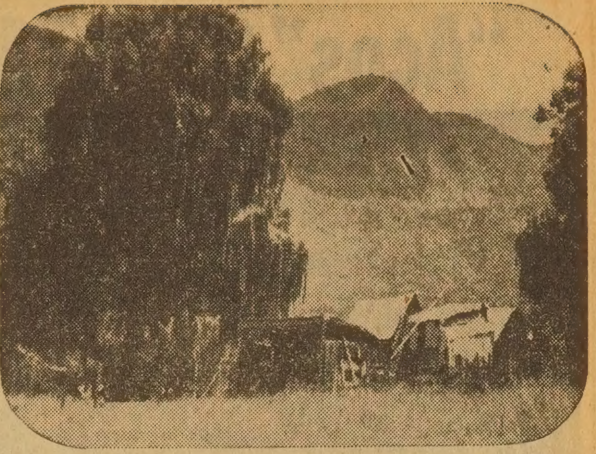


In order to accommodate a wide angle of view on a standard film a special optical system is employed to compress the image in the horizontal plane. As can be seen from the accompanying picture the image on the film is badly distorted as a result but a similar optical system in the projector restores the proportions.

filter will be rejected by a second filter if that filter is set so that plane of polarisation is at 90 degress to the first filter. On the other hand, if the two filters have the same polarisation plane, the light will pass through the second one with very little loss.

To use this characteristic for stereoscopic projection it is necessary to use two projectors, mechanically or electrically interlocked, and each having a polarised filter in front of it. These filters have their polarising planes at right angles to each other. The two images are viewed through polarised glasses having the lens over each eye so adjusted to admit light from the appropriate projector, but to reject it from the other one.

NOT NEW

True third-dimensional still and motion pictures, using this principle, were demonstrated as long ago as 1936, so that the pictures now about to be released do not represent any startling new discovery, but are merely a re-hash of what has been possible for many years.

Another third-dimensional system, developed some year sago, was the "Vectograph" system. This made it possible for two polarised images to be accommodated on the one film, thus saving the cost of an additional projector. While a very attractive scheme on paper, the fact that little has been heard of it in the recent turmoil suggests that there are still problems to be overcome.

The ideal third-dimensional system is one which would produce a true stereoscopic effect, satisfying all the requirements already mentioned, without the viewer having to wear special glasses or be in any other way restricted. Such a scheme has been the dream of inventors for years but, at the present state of our optical knowledge, it seems as far away as ever, with a very real possibility that it will never be achieved.

The closest approach to this ideal is a system developed in Russia and another in Australia. In each case the images from the two projectors are made to occupy very narrow channels and to lay side by side so that if the viewer places his head in exactly the right position, his right eye will intercept rays reflected from the right projector and his left eye rays from the left projector.

TWO METHODS

In the case of the Russian system the effect is achieved by means of a grid of wires in front of the screen, while in the Australian system, a special screen is employed. In both cases, a very large number of twin beams are produced and it has been suggested that the seats of the theatre should be arranged along the line of each pair, the individual viewer then being left to find the correct viewing position.

This scheme satisfies the requirements for true stereoscopic perception but the position of the viewer is very critical and a movement to one side or the other of only a few inches is all that is necessary to lose the effect. This is such a severe restriction that the scheme is not likely to be acceptable to the general public.

So much then for the technicalities of true third-dimensional motion pictures. What is the position at the present time regarding the various film companies?

The industry appears to be divided into two schools of thought. One is following the line of true third-dimensional systems and hoping that the public will accept the restriction of having to wear polaroid glasses, while the other section is concentrating on providing greater realism by means of wider screens and multi-channel sound systems.

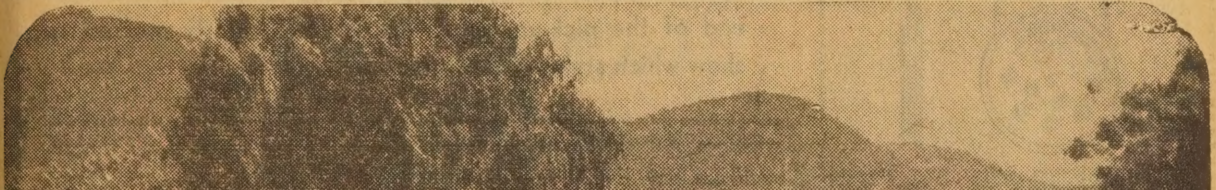
In spite of the claims made by supporters of these latter systems, they cannot in any sense be regarded as third-dimensional systems, and the most that can be said for them is that they will undoubtedly be a considerable improvement on the present limited screen size. While this feature will no doubt be a very attractive one and considerably enhance the entertainment value of the picture, the fact remains that the results are not third-dimensional.

NO GLASSES

However, the wide screen systems have the very definite advantage of not requiring any special viewing devices and may appeal to the general public more than the true stereo systems for this reason.

The forerunner of the wide screen technique was the Cinerama (Radio and Hobbies, Nov., 1952) but this, while very effective, is considered by most film companies to be too expensive to become a universal system. What has been called the poor man's Cinerama is now being developed by 20th Century-Fox under the name of the Cinamascope, and by Warner Bros. under the name of Warnerscope. It is anticipated that

(Continued on page 89)



The image as it appears on the screen. Note the completely new aspect ratio compared with conventional systems. Early experiments have been conducted on a ratio of 2.6 to one, as portrayed above, but it is now suggested that a standard of two to one would be more suitable.

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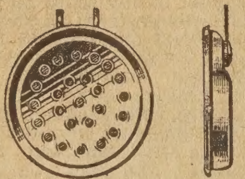

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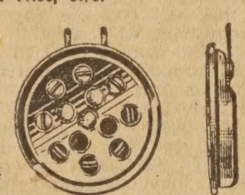

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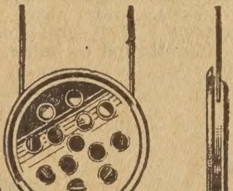

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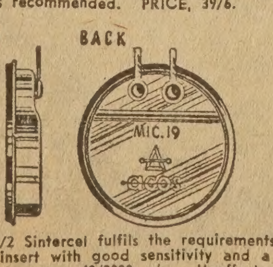

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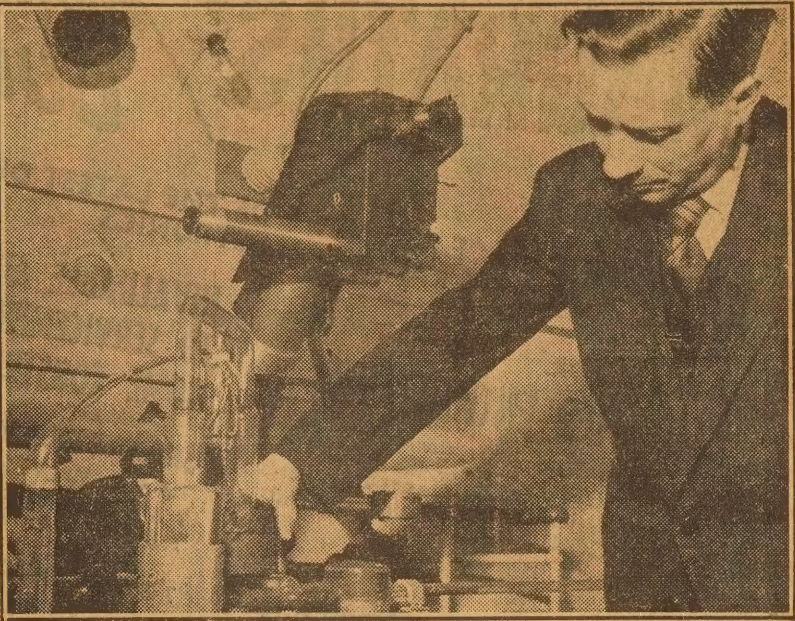
FRENCH ELECTRONIC TELESCOPE

Following on the widespread acceptance of the electron microscope, a French astronomer, M. Andre Lallemande, has announced the development of an electron telescope which is claimed to have great possibilities.



M. Andre Lallemand is shown here examining portion of his developmental electron-telescope. US rights for the instrument have been assigned to the Scientific Research Institute of New York.

THE new telescope needs perfecting, but it has already allowed ood photographs to be obtained of ie heavenly bodies, and some of iese were shown to the Academy of ciences last September. Compari- on of the pictures with ordinary hotographic images emphasised the rogress that has been made.

The idea of using electrons for as- o-photography is relatively old. It ates back to the beginning of the entury, when Einstein first discov- red the laws of photo-electric effect. cience had to wait, however, till idustry could produce cells suffi- ently sensitive to transform weak ght energy into useable electric nergy.

Thus, it was not till about 1923 iat astronomers became interested 1 the photo-electric cell. M. Roug- r, at the Strasbourg Observatory, uilt a photometer of this kind. M. lenroteau, at the Ottawa Observa- ory, constructed a spectograph vhich used an electron multiplier nd cut down enormously the time ivolved in photographing the stellar pectra.

ELESTIAL TV

M. Henroteau had also thought of elevising heavenly bodies, but the onoscope he had to use gave a ough image that was not suitable or scientific study. The science of ectron optics was necessary to lve the problem.

At this time the Americans had ecided to construct a giant tele- ope, whose lens would be double iat of the Mont Wilson lens, and, onsequently, four times as power- il. (This 200-inch telescope is at resent in use on Mount Palomar.)

Unable to rival the United States astronomical equipment, and eptical, too, as to the service such 1 instrument would render all the ear round, French astronomers ondered if it might not be better tackle the problem from the op- osite end and try to improve the nsitivity of the photographic uipment.

Such was the opinion of M. Andre anjon, who was then director of e Strasbourg Observatory.

It was this viewpoint that spurred 1 the research work of his col- borator, M. Andre Lallemand, in 34.

At this time the first electronic icroscopes were already being nstructed on the principles laid wn by Busch on the application wave mechanics. Electric or magnetic fields concentrated electron groups on small objects, and gave larger images of them than the usual optic images.

M. Lallemand proposed to transform the optical image of a celestial body into an electronic image by the use of photoelectrics, but his problem was to get sufficient electrical output. At the same time, the promise of the system was obvious.

It was known that light is made up of small corpuscles called photons, which are divided uniformly on the curve of the wave. A photon striking a sensitised surface may expel an electron from it, but the thousands of photons that make up a beam of light are not all capable of expelling electrons and the yield is slight.

by Rene Sudre*

On the other hand, to obtain a given change of silver bromide on the photographic plates, rapid electrons are a hundred times more effective than photons. In astronomy, where it is sometimes necessary to expose for many hours to collect by accumulation the very weak light of distant bodies, the harnessing of electron energy is an important advantage.

Begun in 1936 at Strasbourg, M. Lallemand's experiments showed that an electronic telescope was feasible. If the sensitivity of the photographic emulsions could not be increased, they could at least be made to register all the incident photons, each of them possessing a higher actinic energy, by making use of the photo-electric effect.

The image of the body was projected on to a potassium cathode, placed in a vacuum tube and held at a potential of 48,000 volts. This potential gave considerable acceleration to the electrons emitted by the cathode.

The beam was concentrated by a magnetic field and formed an image on a fluorescent screen on which it was visible. By replacing the screen by a sensitised plate a negative was obtained in a few seconds, which would have required a hundred times as long in direct registration.

The small 50cm opening of the telescope, which M. Lallemand had at Strasbourg gave theoretically the same result as that obtained by the big telescope at Mount Palomar!

M. Lallemand's original research, which was interrupted by the war, was recommenced at the Liberation, and carried on in association with M. Maurice Duchesne.

Meanwhile, much progress has been made in the manufacture of photo-electric cathodes, particularly in the greater sensitivity given by antimony-caesium. The photocathode began to look like being the ideal light receiver, because all the photons are finally transformed into electrons provided they are given time. Moreover, the electronic image faithfully reproduces the light image, and there is no obvious "no-image" threshold as there is with photographic plates.

(Continued on Page 43)

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* *From Paris By Courtesy of the French Embassy.*

MAGRATHS' Monthly BULLETIN

MAY, 1953

WATCH THIS SPACE FOR NEWS OF THE LATEST DEVELOPMENTS IN ALL PHASES OF RADIO & ELECTRONICS

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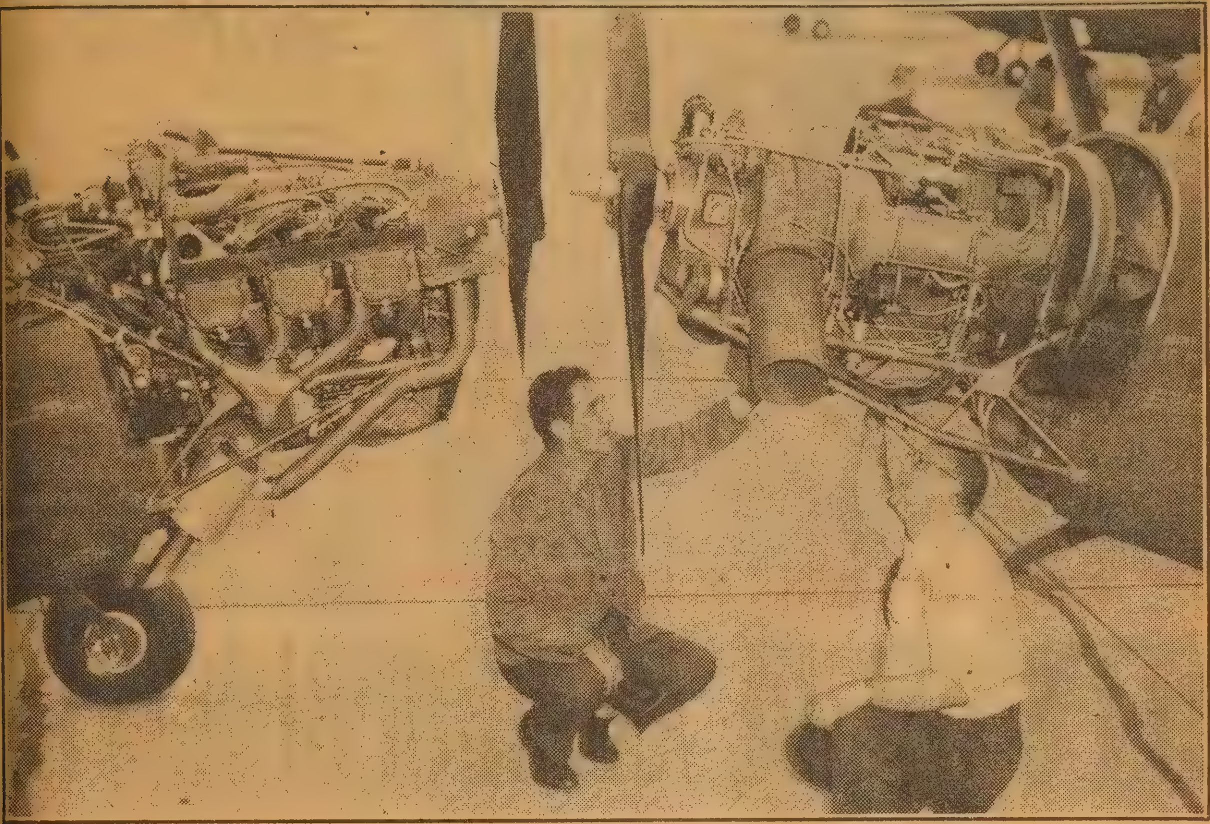
FIRST TURBO-PROP LIGHTPLANE



Compare the apparent simplicity of the turbo-prop motor on the right with the convention 6-cylinder opposed motor on the left.

The Cessna XL-19B, the world's first turbine-propeller light airplane, has successfully passed its initial flight tests. The Cessna "Bird Dog", powered by the new Boeing model 502-8 gas turbine, has been under test since November 5, at the Cessna Aircraft Company, Wichita, Kansas.

THE turbine-powered light plane project is a joint development program of Cessna, Boeing Airplane Company, the US Army and the US Air Force. The engine is an outgrowth of a joint Boeing-US Navy program of several years' duration.

The Cessna L-19 is a proved combat veteran of the Korean campaign and has been exceptionally valuable for observation work. In September of 1951, General Mark Clark, then Chief of US Army Field Forces, at a dedication held at the Cessna Wichita Plant, officially nicknamed the L-19 the "Bird Dog." Cessna Aircraft is the only company manufacturing the L-19.

Cessna's Chief Engineering Test Pilot and Aerodynamicist, Hank Waring, who made the initial flight in the XL-19B, reported that control characteristics of the turbo-prop airplane are equally as good as the standard piston engine L-19A, now in production.

In order to install the Boeing turbine in the XL-19B, it was necessary to make minor modifications of engine mounts and cowling. The modifications include additional internal air intake ducts and a new oil radiator support. A standard two-blade McCauley metal propeller is used with a slight variation in pitch.

Instrument changes include tachometers for the first and second stage turbine, tail pipe temperature indicators, high pressure fuel gauges and modifications of the electrical circuits.

One advantage of the new installation is a saving of some 125 pounds of power plant weight. This saving of weight will make possible increased performance or an increase in useful load. The normal Cessna L-19 power plant is a six-cylinder opposed piston type engine.

EXHAUST GASES

Unlike a pure jet engine, the Boeing turbine utilises the exhaust gases from the jet power-producing section to drive a propellor shaft through a second-stage turbine wheel and a reduction gear system. The engine in the XL-19B is a modified version of the original Boeing 502 turbine. It weighs approximately 250 pounds, is rated at 210 h.p. on takeoff and has a cruise rating of 175 h.p.

The advantages of the turbine over the conventional engine include simplification of power plant installation, elimination of cooling problems, and almost complete elimination of vibration.

The engine uses almost no oil, and its fuel system eliminated the need for fuel mixture control, carburettor, and the attendant carburettor heat control system.

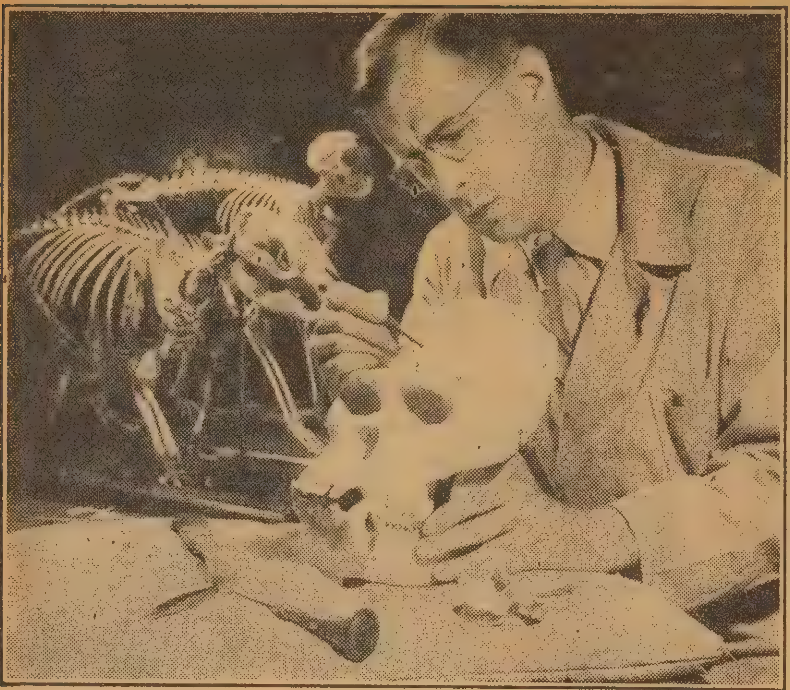
The Boeing gas turbine will operate on diesel fuel, any grade of automotive fuel, army standard truck fuel, high octane aviation gasoline and JP-3 and JP-4 jet fuel. The fact that the turbine will operate on all grades and ranges of fuel increases its advantages in combat zones.

Cleaner air

AN air filter said to remove "at least 400 pc more fine dirt from forced-air heating and air conditioning systems than other filters on the market has been developed by Goodyear Tire and Rubber Co. here.

Named "Pliotron", the product is filled with shredded plastic containing a "life-long electrostatic charge". The plastic traps and holds the finest pollen, soot and dust particles the same way a magnet attracts metal, the company says.

"Pliotron" filters can be installed in present forced-air systems and are easily cleared in a few minutes by rinsing in clear water



Skulls, fossils and dark caves are the stock in trade of the anthropologist. He's the one man who is expected to have skeletons in his cupboard.

LET'S ALL BE ANTHROPOLOGISTS

Anthropology is a science which is generally considered by the reading public as a dry subject dealing mainly with the excavating of tombs of the ancient Egyptian Pharaohs. In reality the Science of Anthropology is a highly interesting one which can be as exotic as the study of maps.

I HAVE yet to find anyone who gains no interest from looking at a map. The reason, of course, is that such a study stimulates the imagination into dreams to travel. You know the old song Far-away Places.

The Science of Anthropology deals with the evolution of the human race. It is the history of mankind from the earliest of times. It uses as its evidence the remains of human habitation in various parts of the earth — remains which are buried in the various earth and rock deposits or strata which cover the earth in layers.

WHAT IS ACCURACY ?

Whether anthropology can be classed as an accurate science is to my mind open to question. Of course, it all depends how one defines the word "accuracy."

Every now and again one reads that some kind of jaw bone has been uncovered from hundreds of feet of dirt overlay. An immediate argument crops up among the scientists as to the age of the bone.

One will say it is 10-million years old. No, says another, it is 8-million years old. Another will say it is between 5- and 7-million years old. What is a couple of million years to these fellows against the billions of years of existence of the earth. So the definition of accuracy must be fairly wide.

Now I will admit that there does not seem much fun in digging around in ghostly, musty tombs, although what is found there is sometimes truly astounding. Withered mummies, dried up daddies, pots and urns, gold and silver and enormous wealth and writing on the wall.

Oh, yes, modern man was not the first to realise the value of writing on walls. Remember the first known edict issued about short weight — "Mene Mene Tekel Upharsin" — "Thou are weighed in the balance and found wanting." This was written on a wall. Or am I mixing my history?

Anthropology covers an enormous number of subjects such as the study of fossils, biology, geology, race, heredity, sociology, music and arts, government, economics, invention, religion, folklore, magic, culture, dancing, subsistence, agriculture, organisation and many other things.

I don't propose to deal with all these matters here. In fact I propose to deal with only one of them. One which to me is very fascinating in that it gives us some idea of the development of ingenuity throughout the ages. It is the subject of invention.

One often hears how badly off we are when the electricity is always failing and granddad says "give me the good old days of lamps and candles." He has something there.

When we look around and see the wonderful amenities with which we are blessed it makes one wonder how people managed many centuries ago.

As a matter of fact, even primitive man was a most inventive sort of a bloke and the gadgets he invented were numerous. Even hundreds of thousands of years ago man was observant. For instance the fact that a falling stone smashed in the skull of anyone in its path no doubt led to the use of stones as crushing tools and hammers.

FIRE KNOWN EARLY

The use of fire was, of course, one of the major attainments of any age and it was applied in very, very ancient times. Evidence shows that in practically all ages fire was used to cook food and primitive man invented the first "pressure cooker."

These were really underground ovens consisting of a hole in the ground in the bottom of which red hot stones were placed. These were covered with a layer of leaves and the food placed on top and covered with another layer of leaves and a layer of soil on top. Water was poured in through a hole and this generated steam which was sealed in long enough to cook the food.

It is amazing how many well-known mechanical principles were known by the ancients. They soon found out that the strength of a blow was increased by adding weight to the hand, such as by grasping a stone. This cracked your covetous neighbor's head much more easily and also led to the easier chipping of stone axes and other implements.

The lever principle was extensively used to shift logs and huge stones. The inclined plane was known many centuries ago and was used to lift stones into position for building purposes.

TORSION PRINCIPLE

The effect of torsion was well known. It was used to squeeze the juice from fruits and barks. The fruit was placed in a kind of mat or bag which had ropes at the end. One end was hung from a tree and a stick was placed in a loop at the other end. This was used as a lever and when twisted it applied pressure to the bag. The "modern" housewife uses a similar principle today to squeeze water from clothes or juice through muslin bags.

Ancient man invented the trap which was held in position by twisted sinews. When released the trap was sprung with enormous force. We use a similar device today but with metal springs.

Thousands of years ago man invented a device based on the disturbance of balance. It was a trap which consisted of a cover over a pit. When a man or animal trod on the cover it tipped over thus projecting the victim into a hole full of spikes. The cover then resumed its original position waiting for the next victim.

The principle of the roller was and is still used by Indians for moving heavy articles and the Eskimos even use pulleys of their own invention to haul whales and sharks from the ocean.

HUMAN PUMPS

When primitive man wanted to draw water from a hole in the ground he used the principle of suction. He inserted a hollow tube of rush or bamboo and sucked the water up into his mouth. He then squirted it into hollow receptacles such as coconut shells or ostrich eggs from which the contents had been extracted and previously eaten. He wasted nothing.

Other mechanical principles whose effects were utilised were the reduction of friction by covering the runners of sleds with ice. This is still extensively used by the present day Eskimo as is also the use of rollers in transporting canoes over long distances.

The effects of varying specific gravity were well utilised. Man soon found that a hollow log floated higher in the water and carried heavier weights than a solid log, thus the canoe came into being. Floats were made of skin bags or light wood and were used to hold nets up in the water while the lower portion was held down with heavy stones and such like.

Even in canoeing mechanical principles are utilised. For instance the paddle is a lever, one hand is a fulcrum and the other is the motive power. Rowlocks were also used. These were made from twisted cords or sinews. Experiment and observation soon taught that various methods of paddling enabled the paddler to steer a straight course notwithstanding the one sided effect of a single paddle.

CENTRIFUGAL FORCE

Centrifugal force was utilised in the sling. When David slew Goliath he used this force. In rotating the sling and suddenly releasing the string, the stone is propelled with greater force than even a baseballer can attain with the hand alone. Remarkable accuracy was attained with such weapons. The ancients even played with tops and bull roarers, which depended on the principle of centrifugal force.

A bull roarer is easily made by taking a flat stick about one inch wide and six inches long and one-quarter of an inch thick. Bore a hole in one end and tie a piece of string about three feet long to it. Swinging this quickly round over the head produces a weird noise. We played with these things at school, but the art seems to have died out. I am not, however, inferring that I am a primitive man.

Certain chemical processes were widely appreciated by very early man. He was an expert at extracting the poisons from plants with which he tipped the points of his spears. He found a means of making dyes and paints of a sort with which he dyed skins and painted his pictures and wrote on walls as aforementioned.

by Calvin Walters

When it came to making grog, modern man had nothing on man of thousands of years ago. Even the Australian soldier in the jungle could not make "jungle juice" to equal that made by his remote ancestors, even allowing for such modern ingredients as boot polish, fly spray and spirit varnish. The effects of fermentation were well understood by early man and many drinks were concocted with which to welcome notables from other tribes. There were no liquor commissions in those free-for-all days.

Early man knew how to make materials watertight by covering with natural pitch or clay. He made canoes from these materials and his clothing consisted of treated hides—that is if he was modest enough to wear clothes.

Very remarkable was the knowledge of acoustics such as resonance, the vibrations of strings and air columns.

As instance of this is the great variety of drums used. Stretched skins were found to be capable of producing sound. When stretched over a hollow space the sound was strengthened by resonance. Methods were even devised to vary the tension on the skin to give varying tones.

One type of drum called by us the friction drum was actuated by means of a string fastened to the centre of the skin. This is set in vibration by rubbing the hand up and down the string.

Even the wooden blocks used today in dance bands were invented by primitive man. He found that different-sized objects made different tones and this in turn could be varied by the nature of the material used.

PRIMITIVE "JIVE"

By rubbing notched sticks or drums with a stick peculiar tones are produced.

Intestines of animals were used as strings in some instruments and increased the effectiveness of them. For instance, he discovered that a spear is far more effective and carries further when it is weighted at the far end. Many tribes especially in Africa developed very effective knives used for throwing.

Even the effect of wind pressures was made use of by our stone age Australian aboriginal when he made the boomerang. This flat curved board has its ends twisted in such a way that, if it fails to connect

(Continued on Page 93)

The crumbly chalk deposits of England have yielded many interesting relics of the past. (There is no truth in the suggestion that this picture was taken in Calvin Walters' back yard. Ed.)

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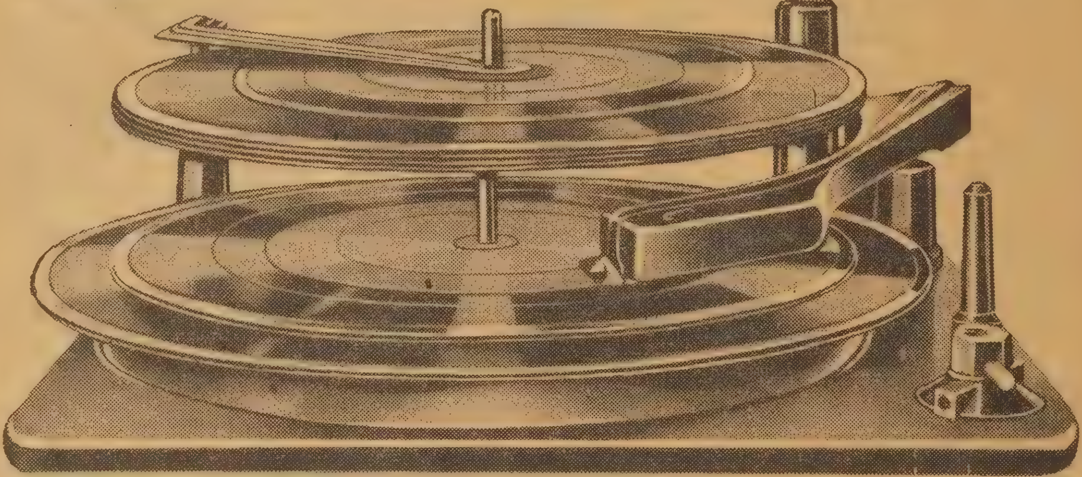

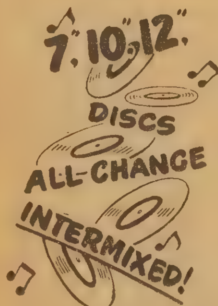

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Technical Review

RCA CLAIMS A NEW "HIGH" IN RECORDING STANDARDS

Over the years the goal of all of the people who work on phonograph records—development engineers, musical directors and recording engineers—has been the same, viz, to bring to listeners in their living-room the same emotional experience they would have received had they attended the actual performance.

OVER the years the improvement in records and reproducers has resulted in sound more nearly approaching this goal.

One of the big steps forward was the introduction of the long-playing record. Since that time, development work has continued and has now resulted in a further improvement, which we have called "New Orthophonic."

RCA Victor's "New Orthophonic" records are characterised by four principal features: (1) complete frequency range; (2) no loss of high-frequency response from the outside to the inside of the record; (3) ideal dynamic range for home listening, and (4) improved quiet surface.

In order to reproduce the full orchestral color, it is of course necessary that all the instruments be recorded and reproduced with the same balance that would be heard in the concert hall. This requires that the acoustic environment of the orchestra be properly selected, and that the microphones be properly located.

PROPER BALANCE

When this is done, we achieve a well-defined orchestral tone, with each instrument in perspective.

One failing of the disc record has been that as the recording goes toward the inside, which means that the groove moves past the stylus more slowly, some loss in brilliance has resulted. A scheme of electronically heating the record stylus eliminated this loss in brilliance.

The same technique also results in a subsidiary advantage. Grooves cut with cold styli had microscopically small "horns" projecting above the surface of the record. These "horns," because of their extremely small size, were very delicate and, therefore, easily damaged by rubbing the surface of the record. The use of electronically heated styli has eliminated these "horns" and thus has made the record less susceptible to scuffing.

The third feature of "New Orthophonic" records is that their dynamic range is ideal for home listening.

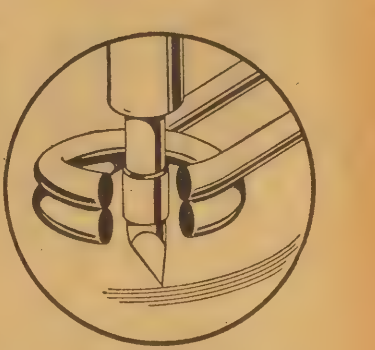
It is sometimes suggested that the objective of the recording engineer should be to bring the performer into the living-room. While this may sometimes be the desirable objective for an instrumental or vocal record, it is obviously not for an orchestral record.

Actually, it has been established that the dynamic range needed to produce concert hall illusion is a function of the size of the room in which the sound is to be heard. Therefore, careful attention is given to the adjustment of the dynamic range on the record for living-room reproduction. The best results are achieved when the adjustment is made through the choice of the proper acoustic environment and microphone placement.

Surface noise has long been a bugaboo to the listener, the engineer, and the manufacturer. Basically, there are four sources: (1) the operation of cutting the groove in the original master; (2) the plating process used to make the stamper that moulds the record; (3) coarse material in the plastic compound; and (4) imperfect moulding of the record.

The use of electronically-heated styli has, in addition to the advantages outlined earlier, eliminated practically all of the noise that occurs in the original cutting. Improvements in electroplating processes and in moulding methods have materially reduced noise from these sources, and the use of synthetic plastic compositions for the record has virtually eliminated that source of noise, in addition to the more obvious advantage of producing a non-breakable record.

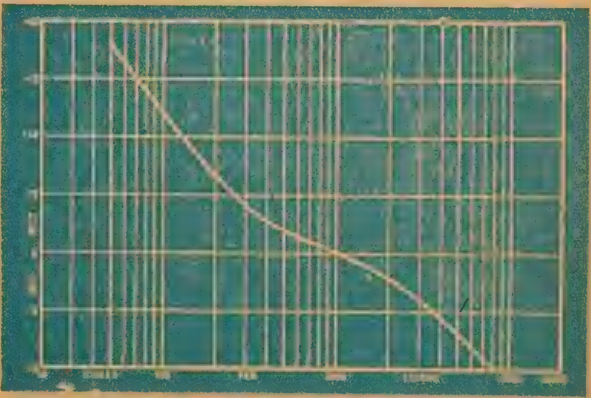
While the ultimate goal of complete elimination of all forms of noise has not yet been reached, we believe that "New Orthophonic" records represent a new standard in reduced surface noise.



Electronic heating of the stylus by a radio frequency field minimises loss of brilliance in the inner grooves as well as lowering noise level.

AES PLAYBACK CHARACTERISTICS

The "Audio Engineering Society's" preferred curve for transcription playback (and conversely for recording) is gaining wide acceptance in Australia, being recently adopted by E.M.I. It closely resembles accepted microgroove compensation but shows somewhat less pre-emphasis than the older "N.A.B." and "Orthocoustic" characteristics. Inner-groove distortion is somewhat reduced thereby.



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(As used in Radio and Hobbies tape recorder, March 1953). Constructional details of 6BR7 appeared in issue of March, 1953.

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TRANSISTORS NOW AVAILABLE—AT A PRICE

For what is probably the first time in history, junction type transistors are being offered for sale in the United States for developmental and experimental purposes. But there is no need for immediate excitement. Present selling price looks like being five or six times the cost of a conventional tube and there are no obvious channels, anyway, by which transistors could reach this country in bulk.

THE February issue of "Radio and Television News" carries an advertisement by Raytheon offering p-n-p germanium junction transistors for "experimental and developmental use," with an invitation to phone or wire for price and delivery information.

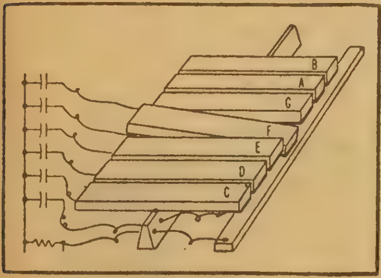
Elsewhere in the same issue is an article credited to a Raytheon engineer showing how type CK722 transistors may be incorporated in a simple detector-plus-audio receiver. The receiver is built in traditional panel and baseboard style and serves purely as an introductory experimental mockup.

The present "novelty" appeal of transistors is emphasised by a circuit in the February issue of "Electronics," showing how a transistor and a selection of R/C networks was built into a toy piano to produce a one-finger transistor organ.

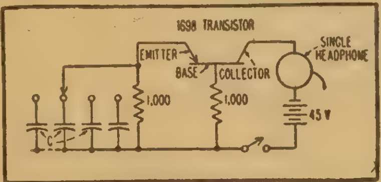
By such means, engineers who have been brought up on the theory and practice of vacuum tubes, will have to become familiar with the application and possibilities of the transistor family.

RCA engineers have already developed for research and display purposes a whole line of familiar items built around their own transistors instead of valves. These include:

- A portable PA system delivering 1.4 watts to a 12in speaker and operating for 25-50 hours from a single 22.5 volt battery.
- A miniaturised personal portable radio using transistors in all stages except the frequency changer.
- A portable FM receiver for the 88-108 Mc. band, using transistors in all stages, including the oscillator and mixer.
- An auto receiver with push-button tuning and good audio output. It operates directly from the 6-volt system, with no HT circuit at all and draws approximately 0.5 amp.



The wooden keys of a toy piano are modified to serve as switches and allow the appropriate tones to be generated when any key is depressed. More complex circuitry allows two notes to be played simultaneously to form simple chords.



The circuit of the R/C oscillator employed in the transistor organ. The tones can be amplified further if required.

- A 45 rpm spring-driven turntable with a built-in transistor amplifier operating for 75 hours from a 22.5 volt battery.
- A miniature phono-oscillator.
- A roving microphone which will radiate its signal over a range of 25ft.
- An electronic ukulele in which the transistor amplifier, batteries and speaker are all contained in the body of the instrument.
- An amplifier in which transistors substitute for both valves and transformers.
- A "walkie Lookie" for roving TV broadcasts. Half the tubes have been replaced with transistors.
- An electron counter, as a pilot project to a completely "transistorised" computer.

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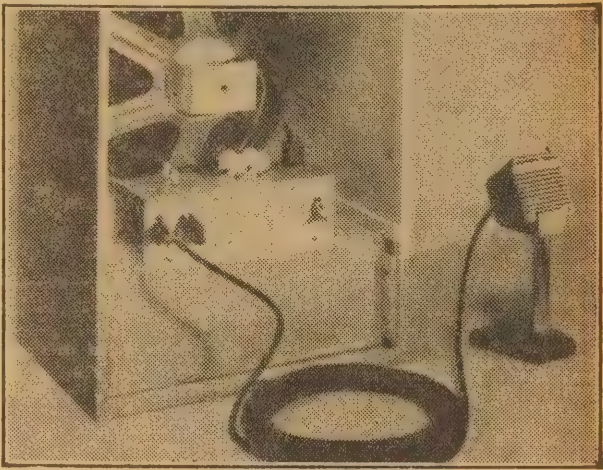
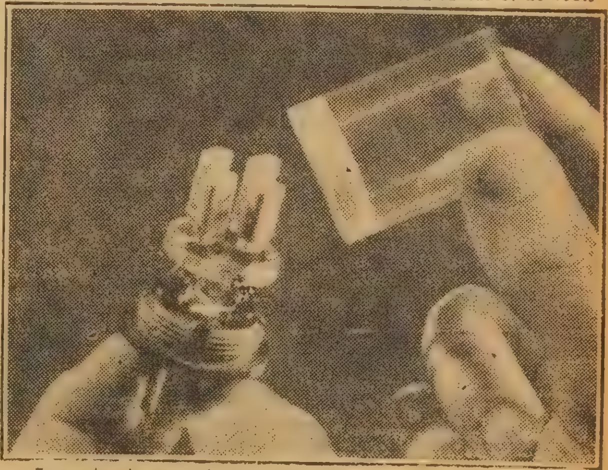


An experimental all-transistor portable P.A. outfit, delivering $1\frac{1}{4}$ watts and operating from one $22\frac{1}{2}$-volt battery.

Tiny dynamic microphone and a 2-transistor transmitter allow a commentator freedom of movement over a radius of 25 feet.



Four developmental transistors, mounted on a tube base, replace both tubes and transformers in an audio amplifier.

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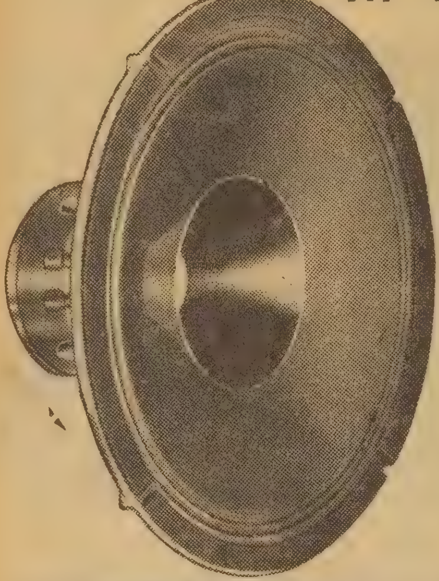

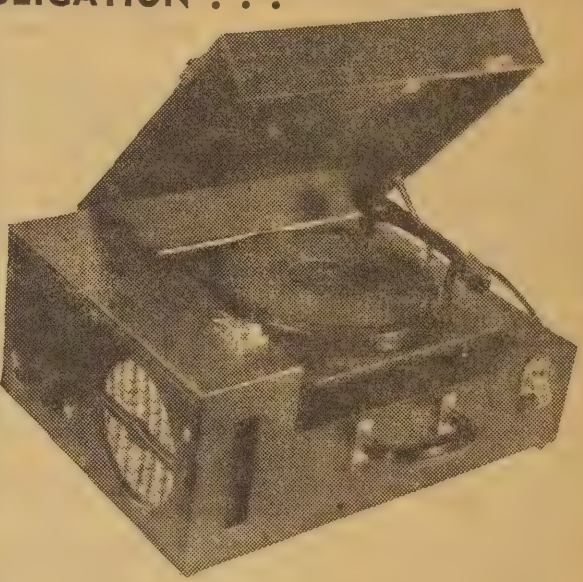

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DETAILS OF THE NEW R-J SPEAKER ENCLOSURE

There has been considerable discussion of late, in American journals, of a new and smaller type of speaker baffle under the name of the "R-J Enclosure". An article by F. Robbins and W. Joseph in "Audio Engineering" for January, 1953, explains the derivation of the R-J enclosure and gives the essential constructional details.

IN introducing the R-J Enclosure, the authors first review the popular types of speaker baffle and sum up as follows:

(1) A flat baffle is unwieldy, requiring dimensions of 11-feet square for good response at 50 cps.

(2) Open-backed cabinets generate a major resonance "boom" and poor response thereunder.

(3) Closed boxes require prohibitive dimensions for sustained low frequency response.

(4) Folded horns are efficient but fairly bulky and difficult to manufacture.

(5) Bass reflex enclosures have thus far been regarded as the best solution to the problem, combining simplicity and moderate dimensions with good results, provided they are properly tuned.

The R-J Enclosure may be compared with the bass reflex enclosure in that both spring from the same basic idea—the Helmholtz resonator. The author's aim, however, has been to produce a practical design which is capable of equivalent results from an enclosure having still smaller overall dimensions.

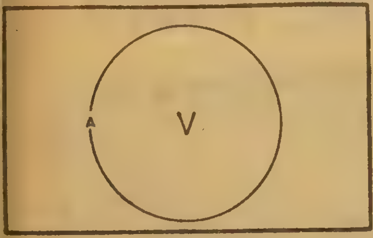

Figure 1: Basic diagram of the Helmholtz resonator.

From this point, we quote the original article:

In pursuing the design of a small enclosure, various types of resonant principles were explored and an adaption of the Helmholtz resonator was finally adopted.

In this type of resonator, Fig. 1, the mass of air in the opening A swings back and forth at resonance and the air in the cavity V acts as a resisting spring against the movement of the air in the opening.

The combination sets up a system analogous to the weight on a spring and has a resonant frequency determined by the mass and the compliance of the arrangement. The equation for the resonant frequency of the resonator is the same as that for the bass-reflex enclosure equation (1).

$$f = \frac{c\,(A)^{1/4}}{2\pi\,(V)^{1/2}}$$

Where A equals the area of the port.
V equals the volume of the enclosure.
C equals the speed of sound in the air.

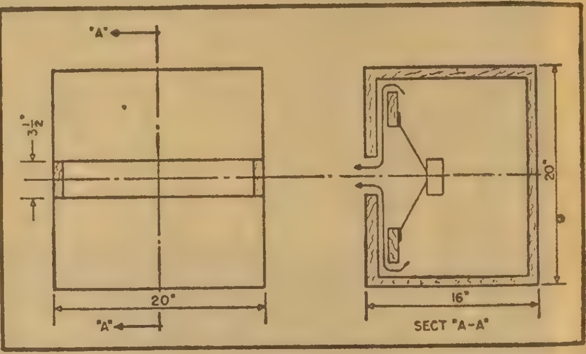

Figure 2: Front and sectional views of the R-J speaker enclosure, discussed in the article. Lacking test facilities, the gap between the speaker baffle and the front of the box would have to be set by the home constructor for best results at the bass end.

Helmholtz resonants are characterised by extremely high Q and if a speaker is placed within such a resonator the response curve will exhibit a very high peak at resonance. If, however, some means to control the Q can be incorporated into the system, a small enclosure could conceivably be designed which would permit flattening the peak.

A practical form of enclosure which attains this end takes the form shown in Fig. 2.

The system still acts as a Helmholtz resonator with the further modification imposed by the creation of a duct system, indicated by arrows in the figure, between the back cavity and the frontal opening.

The resonant frequency of an enclosure with a volume of 4800 cu. in. and a frontal opening of 64 sq. in. calculates out as follows:

$$f = \frac{(1080 \times 12) \times (64)^{1/4}}{2\pi\,(4800)^{1/2}} = 84 \text{ cps.}$$

Actually, close calculations require several refinements to take into account the effect of duct length and the end corrections.

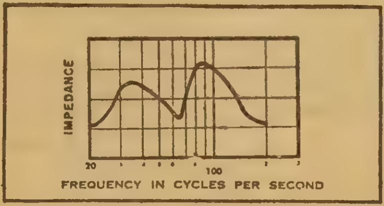

Figure 3. Impedance curve of the R-J enclosure using a speaker having a cone resonance in the vicinity of 50 cps.

Control of the circuit Q is obtained by varying the spacing of the duct produced between the frontal board and the speaker board. By decreasing this spacing it is possible to introduce acoustic resistance to lower the Q and increase damping. The acoustical resistance of a slot is expressed by the equation:

$$R_a = \frac{kl}{t^3 w}$$

Where k equals a constant.
l equals the length of the duct passage.
w equals the width of the duct passage.
t equals the thickness of the duct passage (the spacing between the frontal board and the speaker board).

The acoustic resistance is a function of the third power of the spacing and becomes quite critical as t becomes small. Halving the spacing increases the acoustic resistance by eight times.

By experimenting with the spacing it was found possible to reduce the circuit Q and broaden the resonance so that with a speaker of 63 cps free-air cone resonance, this system extends smoothly to 50 cps without any peak at resonance.

The introduction of the acoustic resistance also has a strong effect upon speaker loading. This is very desirable in improving speaker damping and the magnitude of damping obtained may be judged from the amount of lowering in frequency of speaker resonance below the free-air cone resonance.

As shown in the impedance curve of Fig. 3, the speaker resonance in the R-J enclosure is 32 cps, as against 50 cps for the same speaker in a bass reflex enclosure. It is believed that a 32 cps loaded speaker resonance, as against a 63 cps free-air cone resonance, is considerably lower than can be achieved by other systems.

The international construction of the R-J speaker enclosure is shown quite clearly in Fig. 2. All wood used in the construction is ¾in. plywood, with the external surfaces veneered with suitable hardwood to provide an attractive finish.

The dimensions shown will suffice for either 12 or 15in. speakers, since the speaker size is not critical. The

(Continued on Page 93)

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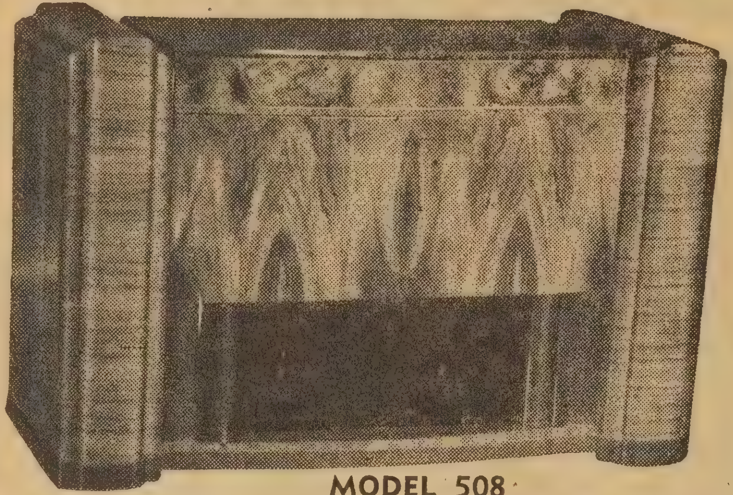

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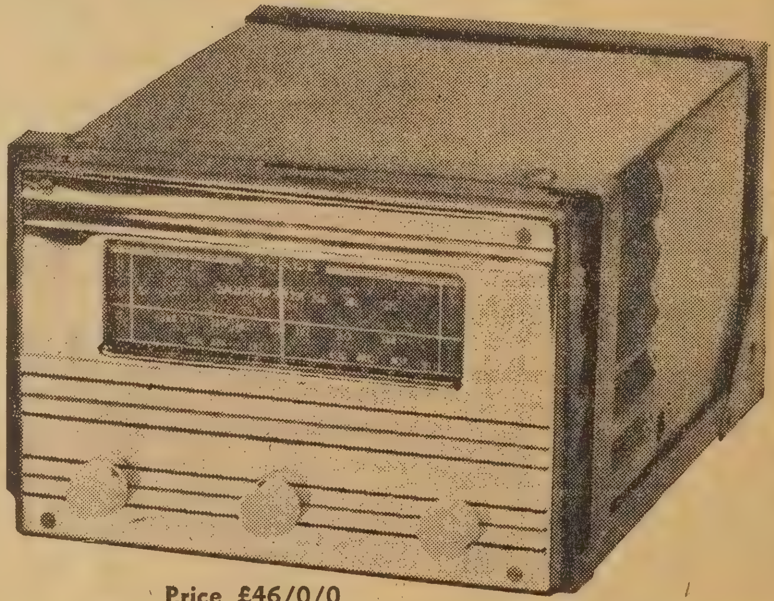

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NEWS AND VIEWS OF THE MONTH

TV on tape

THE latest flash in the theatres v. television battle is TV movies without film.

Bing Crosby's foundation has announced it would release within a year its new video tape recorder that records images, as well as sound, on tape.

Now a film or live TV show can be shot with a television camera and recorded, image and all, on tape. Then the movie-maker can play the tape back, without waiting for any film to be developed.

This means you'll be seeing more and better "kinescopes", of films, of live television shows, and more TV movies. When and if the movie studios get around to the invention, they can turn out their theatre epics faster and cheaper, too. After each scene, the director can play back the tape and tell what he has immediately instead of waiting until the next day to view developed film.

But television will benefit most from the new invention. They can use it to photograph and immediately transmit films of actual news events.

Recent demonstrations of the gadget mark the only times that motion pictures have been projected on a screen without the use of any film.

Better tyres

WHAT may be the tyre of tomorrow, outlasting the life of the car itself and made of a new synthetic rubber, is now being "torture-tested" in Akron.

The tyre is made of sections of high quality conventional natural-synthetic rubber stock and of the company's new "polyester" rubber. It has already undergone 5000 miles of tortuous driving on the rear wheel of a test car.

The new rubber is made from anti-freeze, adipic acid used in the nylon industry, and an ammonia derivative used in the plastics, adhesives and dyestuffs industries.

The company claims that it offers up to five times greater wear resistance than the best tread rubber previously produced.

Shoe soles and heels and heavy duty conveyor belts can also be given extraordinary wear resistance.

Before this new test-tube material can be widely used, however, the company adds, raw materials must be produced economically, efficient processing methods must be developed, and present qualities of resilience and adhesion must be refined.

"Seeing eye" TV

A SIMPLE TV camera—no larger than a hand movie camera—will enable a housewife to exercise visual care of other parts of her home.

It was demonstrated at the convention of the Institute of Radio Engineers.

The device, which plugs into a standard video receiver, has only three tubes and takes its power from the "parent" receiver.

A simple switch changes the home video outfit from regular off-the-air program reception to "closed circuit" operation.

This permits the operator to select any one of a number of points about the home where a camera might be installed.

The camera which weighs only a few pounds and measures 2 x 5 x 10in, can be used with an ordinary camera tripod or placed on a convenient shelf and aimed at a home scene.

Developed primarily for schools, hospitals and factories, where close supervision of many operations is required from a central point, the outfit is expected also to find widespread home use.

ACTH isolated

PURE ACTH, the pituitary hormone used to treat diseases, has been isolated by the Armour Laboratories division of Armour and Co.

Technically labelled adrenocorticotrophic hormone, ACTH was first introduced for medical use in 1949. It's used in the treatment of arthritis, asthma, allergy, rheumatic fever and nephrosis.

Therapeutic effect of the pure ACTH is exactly the same as the ACTH presently on the market, according to Armour spokesmen, so the pure form will not be marketed.

What the pure substance will do, Armour says, is open the way for scientific study of the underlying manner by which the hormone exercises its remarkable effects in protecting against the shock of disease, poisoning or other damage to body cells.

Atomic power

ATOMIC energy would be available for commercial use within five years, according to Mr. Gwilym Price.

Mr Price is president of Westinghouse Electric Corporation, the com-

POPULAR SCIENCE QUIZ

Q. What is "Pinitol?"

A. "Pinitol" is an extract from sugar pine sawdust. According to the forest products expert of the University of California College of Agriculture, it is a possible new raw material for the manufacture of explosives and synthetic resins. About 6,000,000lb could be extracted every year in California from mill waste.

* * *

Q. Is one's blood pressure the same in either arm?

A. Acording to reports in the Annals of Internal Medicine, a Dr. M. J. Reuger has found, after taking 1388 readings on each arm in patients with both normal and abnormal blood vessels, that the blood pressure varies from the left to the right arm.

He says that while the variation, approximately 10 points, may not be significant clinically, it can be of vital importance to the individual. This is particulary true in examinations for life insurance, military service or employment.

He recommends that in the first examination, the blood pressure be taken in both arms and if no difference is present, the same arm be used from then on.

* * *

Q. What is the accepted origin of the word "vitamin"?

A. In 1911, a substance which cured beri-beri, a suffering common among certain prisoner-of-war groups of World War II, was discovered by a Polish chemist. His name for the substance was "vitamine," the "vita" portion of the name coming from Latin for life and the "amine" portion referring to the amine hydrogen in the substance.

Within nine years, three similar substances had been discovered but these did not contain amine hydrogen. This led to the "e" being dropped from the name and an alphabetical suffix was introduced to distinguish between the different substances. Some of the important suffixes now in use are A, B1, B2, B12, C, D, E, K and P-P.

Take, for instance, Vitamin A. It protects your eyes from disease and helps to build healthy body tissue capable of resisting all kinds of infection. It is not, of course, to be confused with a form of immunisation. Yellow vegetables contain this vitamin in an inactive form under the name of "carotene" and which is convertible into an active vitamin by a healthy liver. Fish liver is a source of active vitamin A.

* * *

Q. The use of plastics is increasing in the plane industry but what of the automobile industry?

A. Even at the present time, British scientists have developed a plastic wing for attachment to the metal body of jet fighters. These scientists hope to bring an all-plastic aircraft into reality by 1955 on the claim that it would cut costs in half and speed production.

In the automobile field, the US Rubber Co. recently exhibited a plastic car body about 2/10th of an inch in thickness and weighing only about 185lb. It is claimed to resist denting and rusting and to hold paint well. Heavy impacts may crack the body but the more usual lighter traffic bumps leave no permanent deformation as the body will spring back to its original shape and form.

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pany which recently built the prototype of an atomic submarine engine.

He said his company's newly created atomic equipment department backed up his forecast.

In Washington the Atomic Energy Commission has announced an agreement under which two private firms would make a study aimed at industrial production of atomic power in "the next few years".

The commission will soon ask Congress to end the Government's atomic monopoly.

The commission said the two private firms would:

- See if they could design, build and operate an atomic power plant.
- Examine the economic and technical aspects of building the plant "in the next few years".
- Make recommendations on industry's ability to undertake an atomic power project.

Mechanical heart

THE first surgical operation on a human being with the aid of a mechanical heart has been performed.

The patient was a 16-year-old boy, whose pulmonary artery, the blood channel from the right side of the heart to the lungs, was critically narrowed.

This cut down the amount of oxygen in his blood and thus forced the heart to enlarge to twice normal size.

The mechanical heart, developed by General Motors Research Laboratories and Dr. F. D. Dodrill, of Detroit's Harper Hospital, who performed the operation, was used to re-route the blood outside the right side of the heart.

This allowed the surgeon to open this side of the heart and repair the defective arterial valve in the absence of the blood flow.

The operation took over seven hours.

Now, four months afterwards, the boy's heart has returned nearly to normal size, and he has made a complete recovery.

Atomic diamond

AN "atomic" diamond was displayed recently at the annual meeting of the American Gem Society in Philadelphia.

The diamond, costing 50 dollars (£A22), had been bombarded with gamma rays.

Value after this treatment was about 500 dollars (£A220).

Exposure to the rays gave the cheap stone sparkle and color of an almost perfect diamond.

The new coloring and fire is permanent, according to the company which displayed the "atomic" gem.

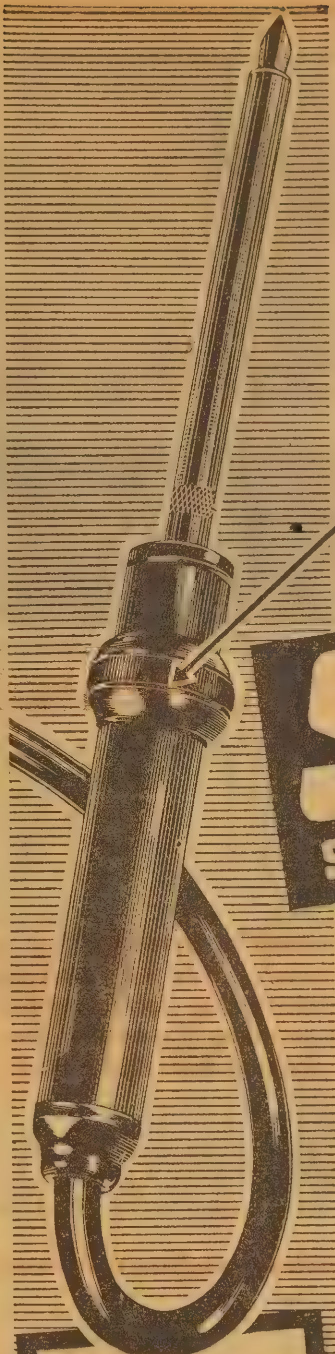
But its tenfold jump in value was largely offset by the high cost of the treatment.

The attending gemologists' view—cyclotron-treated diamonds would never be in competition with naturally fiery stones.——AAP.

2D, 3D, camera

A NEW camera to shoot conventional and three-dimensional films has been announced by Harry Cohn, president of Columbia Pictures.

Cohn said the camera would shoot two-dimensional, and three-dimensional in one operation, so that films could be shown for flat or special screens.



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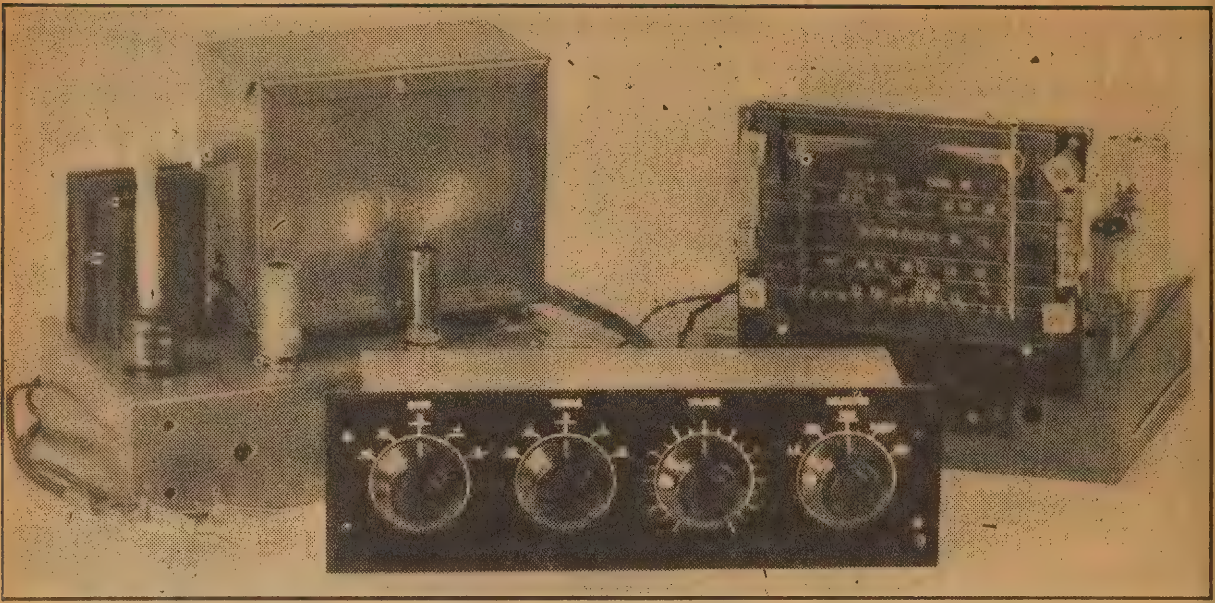


A high quality audio system powered entirely from batteries! The vibrator version of the "Playmaster" Amplifier No. 3 is to the left, the control head in the centre and the tuner to the right.

BATTERY POWERED 'PLAYMASTER'

By extending the basic vibrator amplifier described last month we are able to use it with "Playmaster" control units and tuners. Thus a 6V accumulator supplies the motive power for a complete high quality audio system. The new amplifier has a comprehensive feedback system over the two stages and including the output transformer. Special precautions are taken to eliminate vibrator interference from the high gain preamplifier and tuner.

by Maurice Findlay

THOSE who have followed the "Playmaster" series of amplifiers through its various AC-operated versions will remember that the basic idea is a high quality amplifier into which can be plugged a control head, selecting the input channel and the appropriate compensation.

All the amplifiers in the series achieved the required high quality without running the frequency response into extreme bass and treble regions with the attendant possibility of oscillation at very high and very low frequencies which were evident with amplifiers such as the 807 Triode amplifier of March, 1948.

This latter amplifier had a peak around about two cycles per second, the low frequency end of its range. It frequently showed a tendency also to oscillate at frequencies of the order of 50 Kc.

PERFECT RESPONSE

The "Playmasters" are virtually flat from 20 cycles to at least 30 Kc and show no tendency toward instability at the extremes of the range.

In other words, the advantages of the 807 Triode amplifier are of purely academic interest and in a practical audio system are most likely to be turned to disadvantage.

The Playmaster pre-amplifiers are concentrated in a separate control head which also includes the tone compensating circuits. This arrangement obviates the possibility of hum due to magnetic coupling with the power supply components.

That the "Playmaster" approach to amplifier design is a good one is proved by the popularity of the various "Playmaster" amplifiers with our readers. Hundreds of them have been built since the first of the series was described in the October, 1951 issue. We can recommend them without qualification.

The problem of designing a vibrator version of the "Playmaster" amplifier (in this case the "Playmaster" Junior No. 3 is the AC equivalent) is similar to that outlined in the April issue except that the addition of the high gain pre-amplifier and the further possibility of connecting a tuner make it necessary to employ a more elaborate filtering system in order to avoid vibrator interference.

NOT FOR BEGINNERS

This does put the project rather outside the scope of the raw beginner. Vibrator interference in high gain pre-amplifiers and tuners can occur in most unexpected ways and, if you don't have some experience to tackle any problems that may arise, it would be foolish to undertake the job, unless you can at least enlist the aid of a more experienced friend.

These problems are not so likely to arise in the basic vibrator amplifier described last month, due to the much lower gain. A very straightforward filter circuit is sufficient to remove any possibility of vibrator interference.

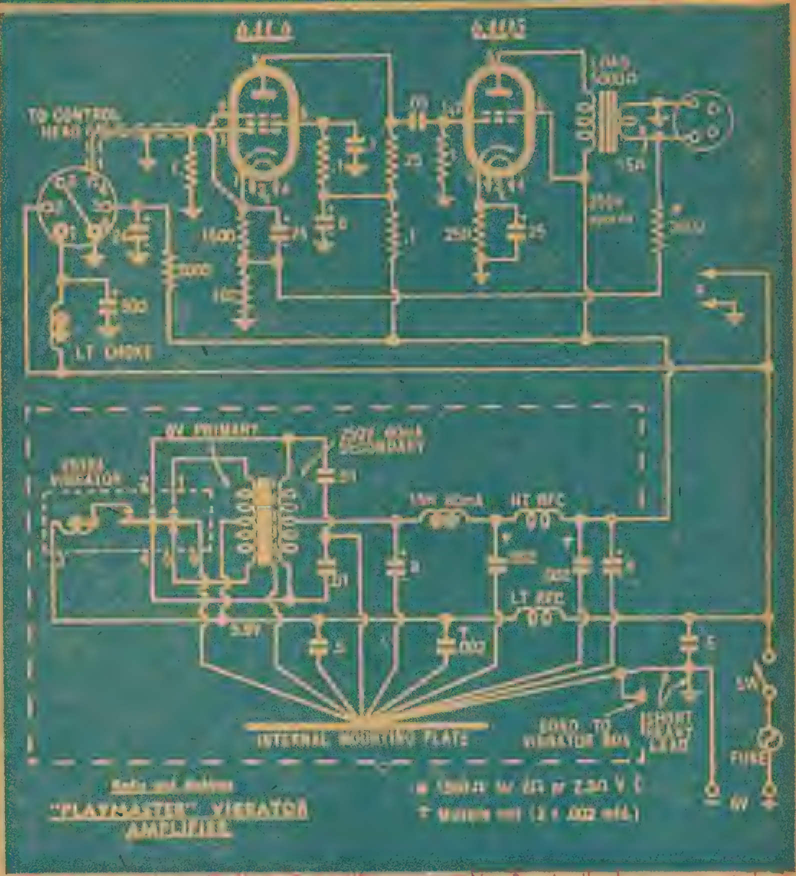
Turning now to the technical details of the amplifier, the problems of supplying the 6V primary current are just the same as discussed in detail last month. It works out that some 4 amps at 6V is required to operate the amplifier proper. With tuner and pre-amplifier connected this may rise to something in the order of 5½ amps.

To provide this you will need a 6V accumulator and some means of charging it regularly. Some readers will have to depend on a motor garage. Others will be able to keep the battery in good condition by exchanging it regularly with the battery from a vehicle which gets sufficient running to keep the battery always well charged.

We also had something to say about the capacity of the battery in relation to the number of hours' service which can be obtained from a single charge. Self discharge, which takes place whether the battery is used or not is an important factor which is frequently neglected.

Before you go ahead with a vibrator-operated amplifier, make sure that you fully appreciate the problems, because the success or otherwise of the project is determined by your baliyit to provide power for it.

SCHEMATIC CIRCUIT DIAGRAM



The circuit is basically that of the "Playmaster" No. 3. A vibrator power supply is substituted for the AC supply making it necessary to install a comprehensive "hash" filter system.

OCCASIONAL FUNCTIONS

Of course, if the amplifier is to be used for a dance or other function which occurs at regular intervals, you will probably be willing to go to a lot more trouble to provide the power.

But if it means taking a battery out of a car just to play a few records for home entertainment you will probably find that, after the novelty wears off, it just isn't worth the trouble.

The "Playmaster" vibrator amplifier is considerably more versatile than the basic amplifier described last month.

The addition of the control unit allows the frequency response of the combination to be instantly adjusted to provide correct compensation for 78 rpm records of both British and American standards as well as long-playing microgroove records. The overall gain is sufficient to take care of the low output magnetic pickups or a lightweight crystal pickup with full compensation.

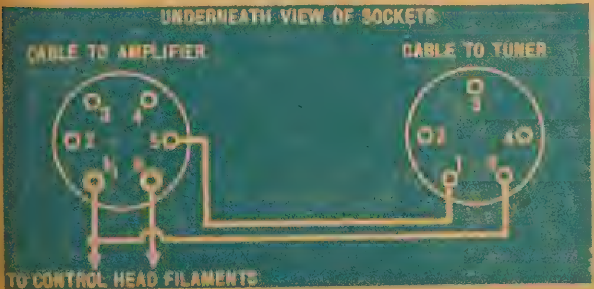
These remarks in general apply to the amplifier used with any one of the three "Playmaster" control heads. However, each has its own special advantages and you will have to decide which one to use on the basis of your own requirements.

The simplest is Control Head No. 1 which appeared in the October, 1951, issue. Using a twin triode type ECC33 it makes provision for all possible recordings as well as having a socket for a radio tuner.

Control Head No. 2 was described in the December, 1951, issue. It is similar to Head No. 1 but includes separate bass and treble controls for further flexibility. Provision is also made for connecting a microphone pre-amplifier.

Control Head No. 3 is a good deal more elaborate than either No. 1 or No. 2. In addition to all the previous features it has a cathode follower output stage and a separate triode section for the microphone

The former makes it a simple matter to maintain the excellent high frequency response of the system in the link between the control unit and the amplifier proper, while the latter obviates the need for switching in a high gain circuit and the attendant possibility of hum on microphone channel.



Wiring of the control heads must be modified for the new amplifier and an extra wire in the connecting cable is required. (See circuit above). Here is the modified filament wiring. Pin 3 of 6-pin socket connects with control head chassis.

Our checks with the vibrator amplifier were carried out with Control Head No. 3, as this is the most likely to be affected by the vibrator power supply.

A modification to the wiring of the control unit is required, but this is the same in all cases and should not cause any difficulty.

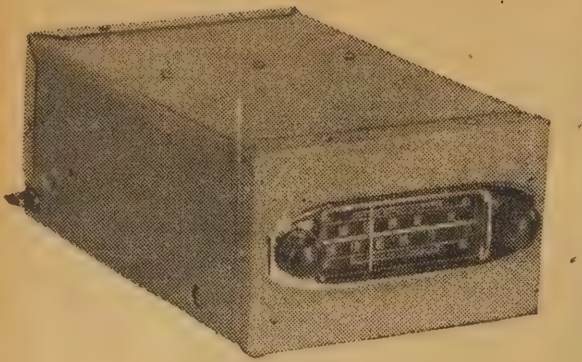
Blueprints of the chassis of all control units have been supplied to the manufacturers and you can order them from the usual radio parts suppliers.

We would refer those who would like further guidance on the mechanical side of the No. 3 control unit to the October, 1952 issue. The descriptive article published therein, includes two photographs of the inside of the unit.

MICROGROOVE PROSPECTS

As we pointed out last month, the position with regards to microgroove records and country readers is not good. Motors to operate from 6V just aren't available, and the old reliable spring motor is not well adapted to handle the 33 1-3 rpm for the 20 minutes or so playing time of a 12-inch microgroove side.

If you can put up with the extra battery drain, an AC inverter could be used to provide power for a regular AC type motor. We believe they are available with 50 cps output and

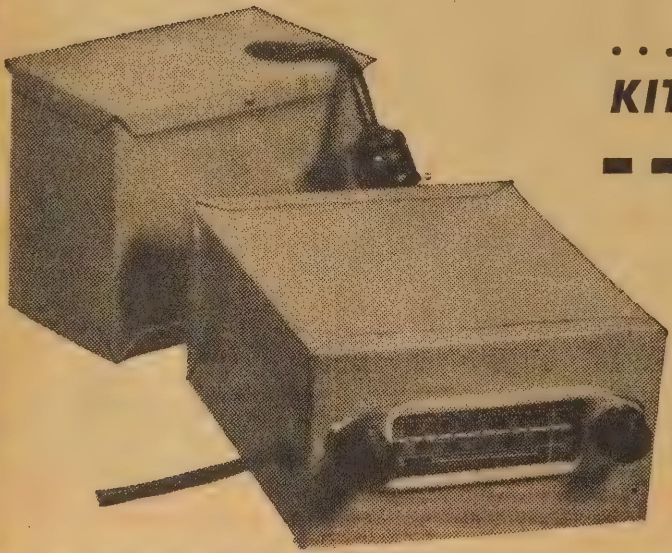


TWO FINE CAR RADIOS

4 Valve Karset (R & H April 1953)

5 Valve Karset (R & H April 1952)

. . . ELECTRONIC PARTS KIT-SETS LEAD THE FIELD



FIRST With The LATEST!

A modern policy of "first with the latest", ensures that Electronic Parts are always ahead in the Kit-Set field. In accordance with this policy, Electronic Parts have added to their already wide range of kits the new 4 valve Karset which was featured in "R & H" only last month. As well as this new Karset, E.P. have the 1952 Karset, a slightly larger unit but one which has 5 valves, and of course a longer range.

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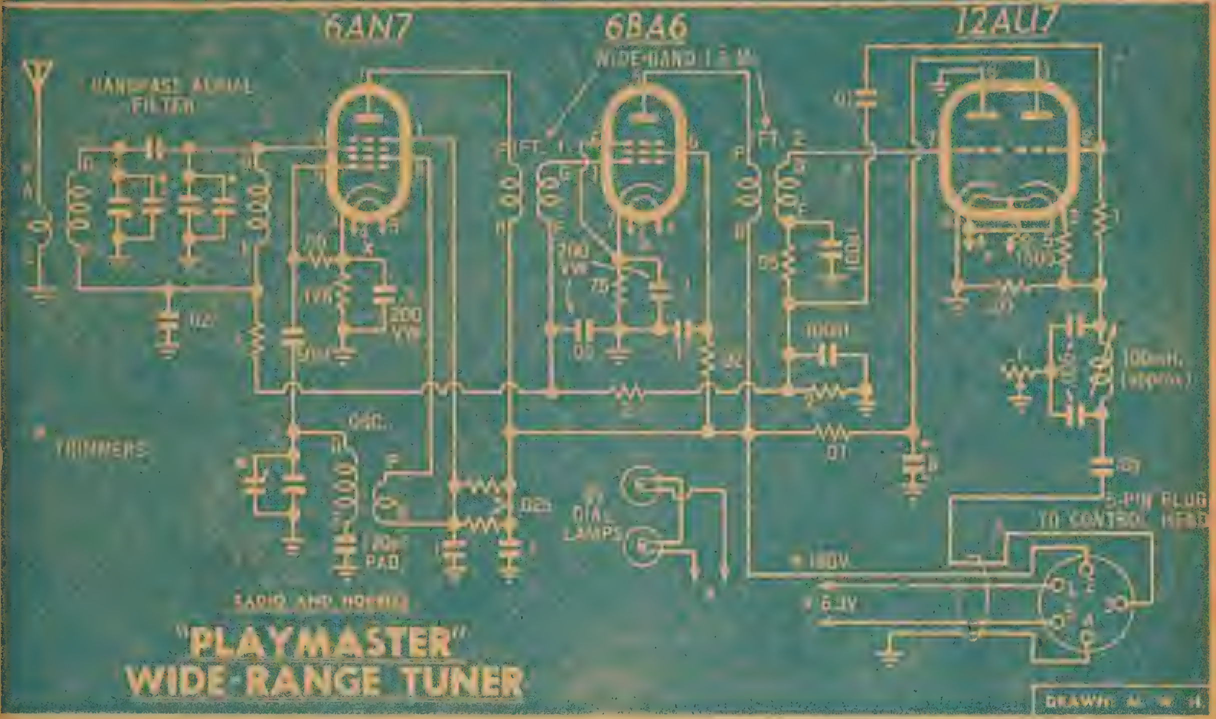
KIT-SET SPECIALISTS

CIRCUIT OF "PLAYMASTER" WIDE RANGE TUNER



The "Playmaster" Wide-Range Tuner. The unmarked "top coupling" condenser in the aerial bandpass circuit is 2 to 3 pf obtained by twisting about 2" of nylex hook-up wire. Note that HT dropping resistors are adjusted for a 180V supply.

that their frequency stability is sufficiently good for them to be satisfactory with synchronous motors.

Governor-type motors could, in many cases, be operated from the 100 cycle output of a simple vibratory inverter described in the April, 1951 issue. However, this would be a point to check before building up the inverter especially for the job. In general, governor-type motors require a greater amount of power than equivalent synchronous motors.

SPRING MOTORS

There is always the possibility that at some time in the future, spring motors for 33 1-3 and 45 rpm will become available. Although existing 78 rpm spring motors are not particularly suitable, there are no fundamental reasons why spring motors for the lower speeds cannot be made. As an indication of future possibilities, we remember reading about a spring-driven, 45 rpm motor incorporated in a record-playing unit put out by a large American organisation.

All three of the "Playmaster" control heads include a socket, into which may be plugged a radio tuner.

Three tuners specifically designed for these control heads having been described.

The "Playmaster" Tuner No. 1 is a superhet, having a switched IF circuit giving normal and wide range positions. It was described in the February, 1952 issue. This was followed in the March issue with the "Playmaster" Tuner No. 2, a TRF, incorporating a cathode follower output, together with a 10 kc whistle filter.

By far the best performance, from the fidelity point of view, is given by the "Playmaster" wide range tuner, which was described in the August issue of last year. It was with this tuner that we carried out the tests with the vibrator amplifier. However, we see no reason why the other tuners mentioned would not work equally well. It is unfortunate that they were not available when the checks were done.

With all the "Playmaster" tuners, the emphasis is on wide range. This is excellent for people within the strong signal area of a radio station, but it is more likely to be a disadvantage to the country listener, who is many miles from the nearest station. Along with the high frequency notes comes so much interference that he is frequently glad to get a listenable signal rather than strive for fidelity.

HIGH PERFORMANCE TUNER

A tuner along the lines of the three-valve superhet tuner described in the May, 1948 issue, or the "Super Tuner," described in the June, 1948, issue, is more likely to be of practical use. You will be able to gauge what you require in the way of sensitivity and selectivity by the performance of other radios operating in the vicinity.

Again, we haven't tried the two superhet tuners with the vibrator amplifier, but see no reason why they should not be satisfactory. Power supply requirements in all cases are similar and will largely determine whether you want a tuner or not.

Incidentally, circuit diagrams for all the items mentioned are available through the 2/- query service in the usual way. Up to three items may be had for the single query fee.

There will be plenty of people within the strong signal area of a regional station, or even the city stations, who do not have AC power and, therefore, will be able to make use of a high fidelity tuner with this amplifier.

Other than shielding the audio lead from the tuner to the control head no alteration to permit operation from the vibrator amplifier was required in the case of the "Playmaster" wide range tuner. It was found that with this lead common with the filament leads, a very slight buzz was picked up from filament lines in the same cable should the shielding be omitted.

A slight modification to the wiring of the control head as originally published, is required for the vibrator amplifier. Filament power for the tuner is obtained direct from the 6V line as with the amplifier proper. However, it was found essential to have a filament supply completely filtered of vibrator ripple for the high gain preamplifiers.

An iron cored choke and electrolytic condenser do an excellent job of filtering for the preamplifiers, but the current-carrying capacity of the circuit is not sufficient to permit filtering of the tuner filament supply as well.

HEATER CIRCUIT

The accompanying diagram shows how the control unit heater wiring should be amended to suit the vibrator amplifier.

Coming to the amplifier proper, there have been a number of changes since last month to bring it in line with the "Playmaster" series. As you will notice in the photograph, a high quality output transformer is mounted on the chassis alongside the power supply. The leads from the output valve to the transformer are about

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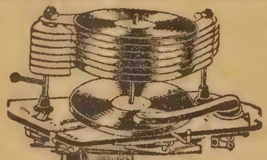

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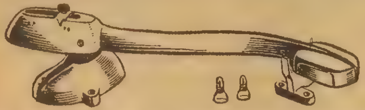
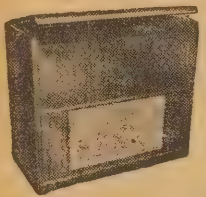


★ RADIOGRAM CABINETS ★



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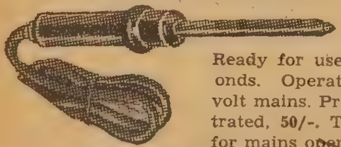
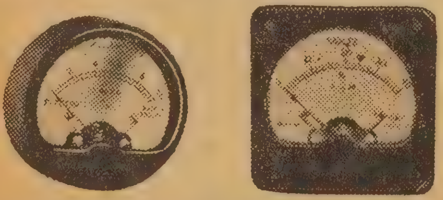
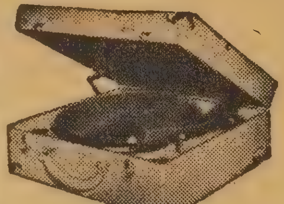


Ready for use in six seconds. Operates from 6 volt mains. Price, as illustrated, 50/-. Transformers for mains operation, 47/11.





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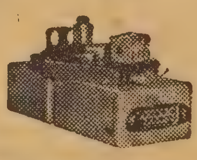

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- ★ Type CD17 Cord drive Dials only 7/11.
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290 LONSDALE STREET, MELBOURNE. **Central 4311**

9in. long, but this does not have objectionable effects.

The valve socket hole in front of the transformer is filled by a 6-pin socket, into which is plugged the cable from the control head. Connections to the socket are so arranged that the audio lead going to the grid of the 6AU6 is surrounded by leads which are "cold" with respect to audio.

Feedback is taken from the voice coil of the speaker transformer to the cathode circuit of the 6AU6, so that it is effective over both amplifying stages and includes the output transformer.

If the amplifier is violently unstable when first switched on, it is probable that you have positive rather than negative feedback. The remedy is very simple. Reverse the connections to the leads from the transformer voice coil winding.

2 OHM VOICE COIL

For a 15 ohm voice coil, the correct value for the feedback resistor is 3500 ohms, but if you are using a speaker with a 2 or 2.3 ohm voice coil, you will need an appropriate transformer, together with a 1500 ohm feedback resistor.

As the transformer is included in the feedback circuit, an excellent frequency response can be expected, even with an ordinary PA type output transformer. However, a high quality output transformer has the advantage of better overall efficiency and the extra power delivered at the speaker voice coil may make the expense worthwhile.

The vibrator power supply warrants special comment, because the success of the amplifier when used with the high gain preamplifier and tuner depends on its being properly filtered. The vibrator unit is constructed in the standard Radio and Hobbies vibrator box, which was originally specified for the "Kar Set."

Dealers appear to be quite happy to sell the box with internal mounting plate, but without the box and chassis for the "Kar Set" proper.

With the aid of insulating washers, the box is mounted so that it is insulated from the chassis proper at all except one point. Similarly, the internal mounting plate is insulated from the vibrator box and the connection between them made by a single lead.

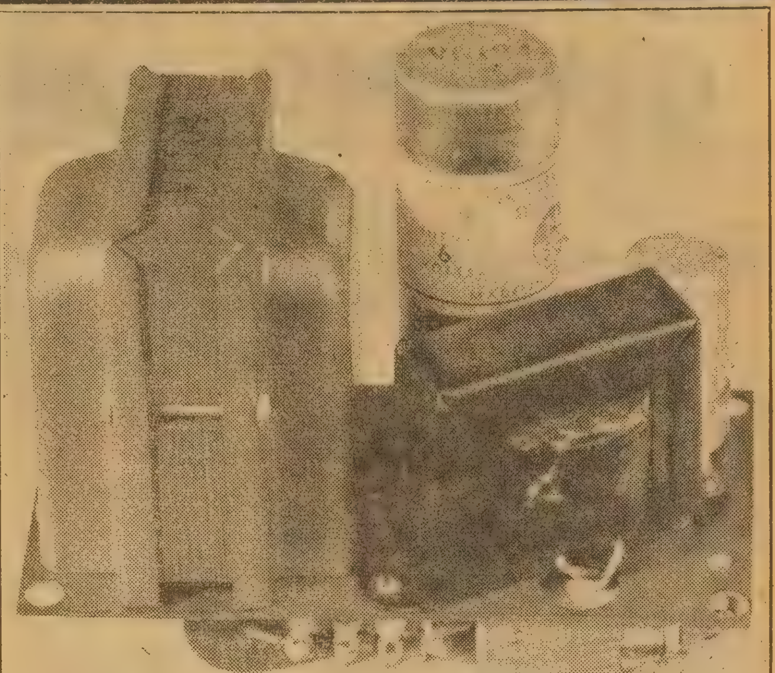
VIBRATOR WIRING

All returns to the mounting plate are made to the point where the interchassis connecting lead joins the mounting plate. We have drawn the circuit diagram so as to give the impression of the correct way to wire the supply.

If you have had experience with synchronous vibrators, you will be aware that it is necessary to polarise the contacts correctly in order that the output be in the correct polarity. As there is often no easy way to tell how the transformer is connected internally, it is usually best to wire the leads to the secondary contacts in a temporary fashion at first, and then reverse them if the first guess proved to be incorrect.

It may sometimes be found that the last remaining vibrator interference can be removed by earthing the vibrator box to the chassis at one or more points other than via the earth return strap. If there does prove to be some interference, try the effect of shorting the case and chassis with a screwdriver blade at each of the four corners in turn. If one or more of these connections prove to give the required result, then it can be made permanent by soldering a copper strap in place.

TWO VIEWS OF VIBRATOR SUPPLY



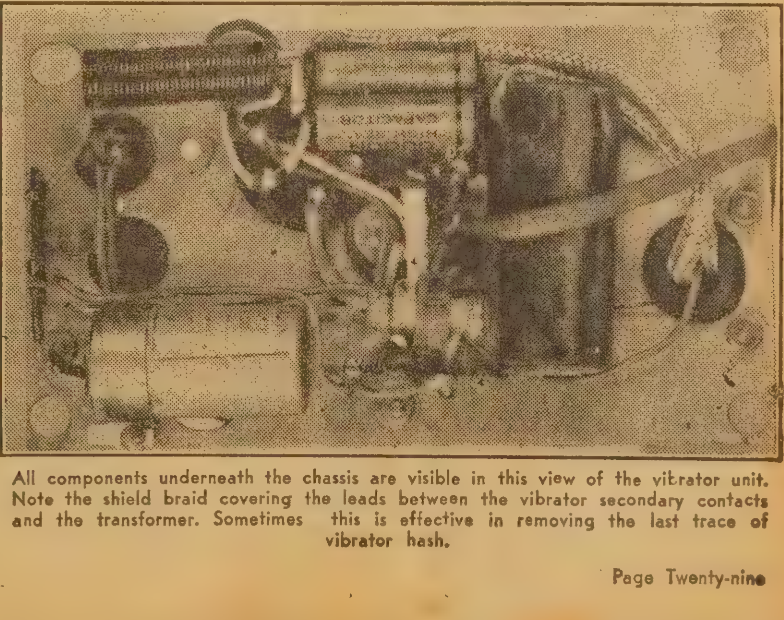
A top view of the vibrator supply shows the transformer, vibrator filter choke and electrolytic condenser. A second electrolytic is visible underneath the mounting plate.

The low tension filtering in the power supply box is designed to deal only with the high frequency component of the vibrator interference. There will still be a certain amount of low frequency ripple in the filament line.

This is of no consequence as far as the amplifier proper is concerned, because of the relatively low amplification. However, it is essential that the filament supply for the preamplifier be free from ripple. An ordinary iron-cored low tension choke of the type used for filament filtering in vibrator receivers using directly heated valves, in combination with a 500 mfd condenser, is sufficient to reduce the ripple to a negligible level.

The current carrying capacity of the choke is not sufficient to permit operation of the tuner's filaments through the same choke. It is therefore necessary to wire a separate circuit for the tuner and we have indicated the change required in a wiring diagram. An extra lead in the cable between the control head and the amplifier will be necessary, of course.

Some form of fuse in the battery circuit is desirable in case of a short in the wiring. It should be able to carry the full current of the amplifier without excessive voltage drop, but



All components underneath the chassis are visible in this view of the vibrator unit. Note the shield braid covering the leads between the vibrator secondary contacts and the transformer. Sometimes this is effective in removing the last trace of vibrator hash.

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VR136 (RL7). 6.3V. UHF Sharp Cutoff RF Pentode. 9 pin Loctal Socket.

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Primary to Secondary impedance ratio will allow them to be used as 10,000 ohms CT to 500 ohm line, output transformers.

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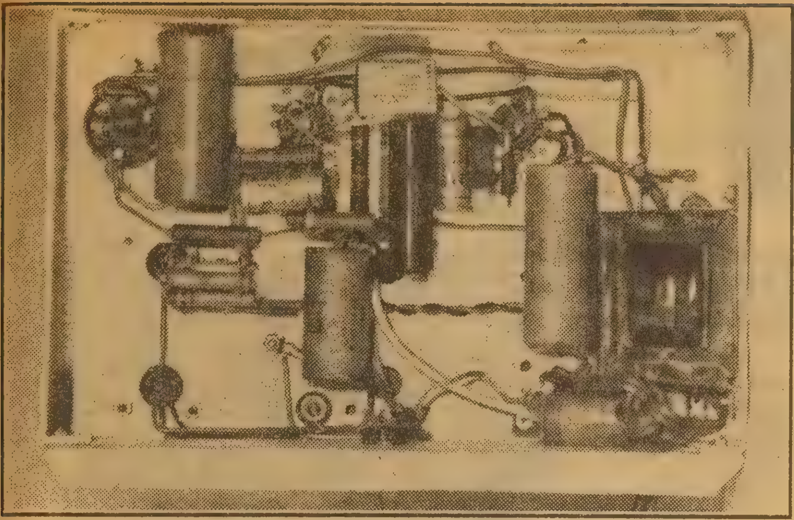
5-6 ANGEL PLACE SYDNEY



The underneath of the chassis looks somewhat more complicated than that of the basic vibrator amplifier published last month. Most of the extra bulk is made up by filter components. The fuse and low tension switch were omitted in our original laboratory model.

at the same time should be light enough to melt before damage is done to other components.

Many readers will also want to include a switch to avoid the need for disconnecting the battery leads. A single contact of an ordinary wafer switch will not safely carry the current, but if you do not have a special switch of the required type, possibly a number of wafer contacts could be connected in parallel.

There are various reasons why readers may wish to operate the amplifier from a 12-volt supply. Possibly 12-volt accumulators are standard with other equipment in use at the same time. The switch will be called upon to handle only half the current in the case of a 12-volt supply, which may in many cases obviate the need for buying a special heavy duty switch.

Although we have not actually tried it, we see no reason why the 12-volt supply should not be successful. It would necessitate a vibrator transformer with a 12-volt primary winding together with a V5258 vibrator in place of the 6V transformer and the V5124.

It would also be necessary to wire the filaments in series rather than in parallel. We would suggest that the 6AU6 be placed on the earthed end of the network, and, as it requires .3A as against .45A for the 6AQ5 it will be necessary to wire a 42 ohm resistor in parallel with the 6AU6 filament.

Similar treatment will be required for the control heads and tuners, but this should not cause you any undue difficulty. Exactly the same wiring between the units will be required.

PARTS LIST

1 chassis 9½in x 6in x 2½in ("Playmaster" Junior No. 3).
1 shield box 6in x 5in x 3½in ("Kar Set" Vibrator Box).
1 mounting plate for above 5¾in x 3¼in
1 vibrator transformer 6V to 250V at 60 mA.
1 filter choke 15H at 60 mA.
1 2.5 mH choke (HT RFC).
1 V5124 vibrator.
1 6AQ5 valve.
1 6AU6 valve.
2 7-pin miniature valve sockets, one with shield.
2 6-pin valve sockets, one with mounting flange.
1 miniature plug and socket.
1 output transformer 5000 ohms to VC.
1 fuse holder.
1 low tension switch.

CONDENSERS

2 25 mfd 40V electrolytics.
1 24 mfd 350V electrolytic.
3 8 mfd 525V electrolytics.
2 .5 mfd 200V paper.
1 .1 mfd 400V paper.
1 .05 mfd 400V paper.
1 3 x .002 mfd ceramic.

RESISTORS

2 1.0 meg ½ watt.
1 .5 meg 1 watt.
1 .25 meg 1 watt.
1 .1 meg 1 watt.
1 3,500 or 1500 ohm 1 watt.
1 1,500 ohm 1 watt.
1 250 ohm 1 watt or 3 watt preferred.
1 100 ohm 1 watt.

SUNDRIES

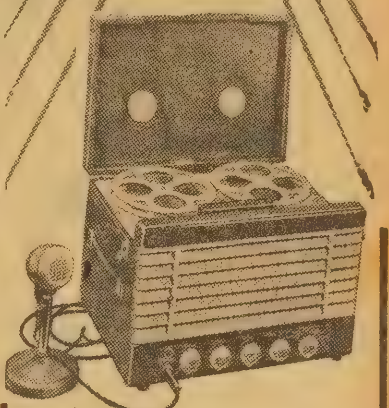
Hook-up wire, shielded wire, tinned copper wire, 18 B & S enam. wire, nuts and bolts (4 bolts 2in long), tag strips, 2 knobs, rubber grommets, solder lugs, two tension cable (plastic flex) &c.

In addition to the above you will need PT1M coaxial cable, large diameter PVC tubing and 2 6-pin plugs for interconnecting cable.

The LT RFC is wound with 18 B & S wire on ⅜in diam. to a length of 1½in.

SPOTLIGHT ON THE NEW

SAPPHIRE
Magnetic
TAPE RECORDER



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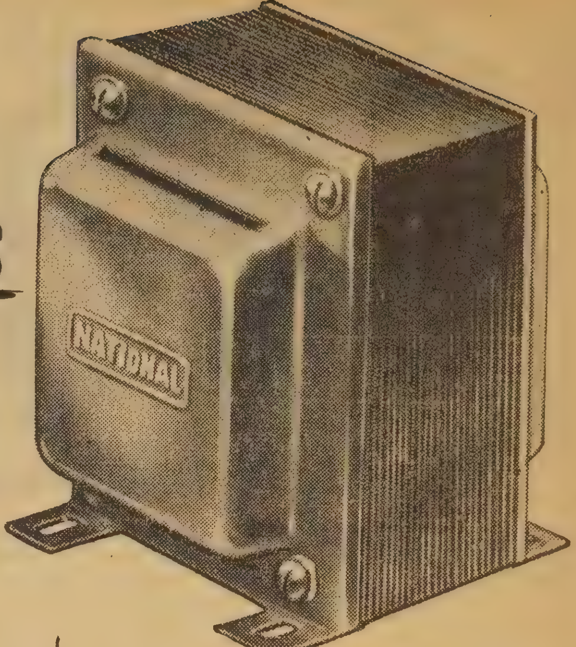

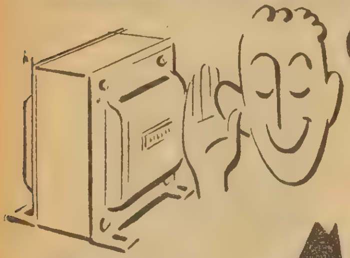

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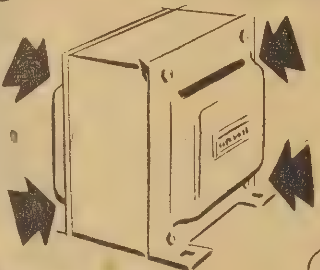
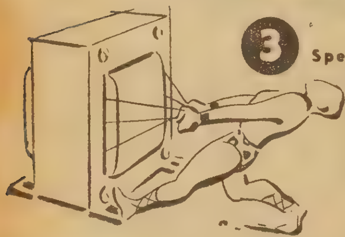
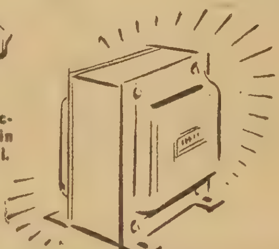


2 Scientifically placed louvres permit up draughts of cool air past windings, thus ensuring lower working temperature and added safety.

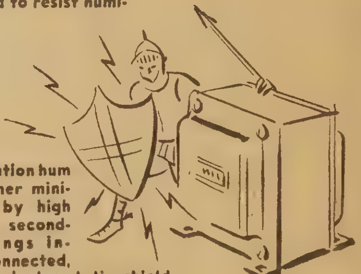


3 Special anchoring method prevents leads being pulled out.



4 Covers are attractively finished in grey stoving enamel.

5 Coil is impregnated with special varnish and baked to resist humidity.



6 Modulation hum is further minimised by high tension secondary windings inversely connected, and by an electro-static shield.

7 Available in an unexcelled range of upright and flat types between 40 and 150m. for both radio and step down applications.

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FROM THE SERVICEMAN WHO TELLS

I have come to the conclusion that this chap Ripley is a mere novice in the collecting of hard-to-believe oddments. What with the fellow who "lubricated" his speaker with glue, the one a couple of months back who "cured" hum by cutting out the speaker cone, and now the latest effort, I'm beginning to fancy myself as a collector.

THE latest story started off in quite normal fashion with a request to fix an old lady's receiver. Before I got around to making a call, a well-meaning relative of the said lady dropped the chassis in, hoping thereby to expedite matters. So far so good.

One glance and I recognised the set as one of the famous old "1933 Standards," featured in that year by Wireless Weekly, the time-honored parent magazine of the present R & H. I gathered that this set had been built by one of the radio shops around town as a "custom" line and had been going more or less ever since.

Right now it wasn't going, for the very simple reason that the rectifier was far more interested in developing blue glows and spitting bits of cathode around than it was in delivering DC to the other valves.

I could see it was a fairly recent replacement, being one of the tubular type 80's. However, it had gone the way of so many other "80" rectifiers.

That one was easy. I reached for an old 80 that I normally have lying about for such occasions but couldn't see it handy and in went a new one, straight from the carton. It should be okay, I reckoned.

STILL NO LIFE

On switching on, the set still seemed virtually dead, although I got some sort of a signal by waving my hand near the autodyne grid cap. The top of the can was missing, by the way, and I picked one out from a few such oddments that I had under the bench.

At this stage it was apparent that the push-pull 59 output tubes weren't in too brilliant form and, by shielding the envelopes from the light, I could just make out light in one of the cathodes.

You might remember that the 59 has two cathodes, with the heaters apparently connected in parallel. Well then, of the four cathodes which should have been alight in the two tubes, there was only one emitting and goodness only knows what condition it was in after presumably 20 years of service.

There was nothing I could do immediately apart from switching off and hoping that I could get a new pair of 59's next day. If not, I'd have to locate a pair of 2A5's and change the sockets from 7 to 6-pin. If there were no 2A5's to be had, I'd still have to change the sockets as well as instal an auto-transformer to operate a pair of 6.3 volt tubes.

Well, to cut a long story short, I got the 59's but at what a price. 28/6 list! Ah, well.

Back on the job, I plugged in the new 59's, cleaned up around the other valves, tightened the sockets and shields and grid caps and switched on for the second time. The set was still far from right, so I tipped it up on end. Next moment there was a flash in the second IF transformer and I reached for the switch.

There was no need for such haste. The new rectifier was no more. It must have been a pretty poor specimen not to stand a few seconds short on the filtered HT line but there was no arguing. Dead it was and dead it would stay.

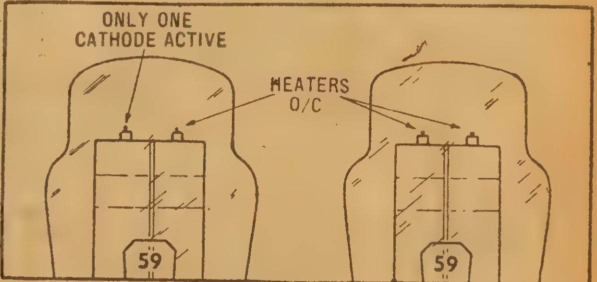
THERE IT WAS

Rather dismally I pulled the top off the old-time IF transformer to look for the short. And there was the missing valve shield top neatly dropped over the windings and hidden from view by the transformer's own can.

How long it had been there, or by what mischief, I can't tell but a newly deceased rectifier was mute testimony to its effectiveness as an HT short. How I wished that I'd plugged in the old 80 instead. Now I had to work out who should pay for the rectifier—myself as a normal hazard of business or the client who presented this crazy set for service.

Anyhow, I found the old 80 this time, restored the cans to their rightful places and tried again. There were weak signals as before, which came up to good strength when I passed my hand or the aerial wire anywhere near the lead connecting to the grid cap of the autodyne. The RF grid circuit and the aerial terminal seemed to be very unresponsive.

Looked like trouble in the RF stage!



This old "1933 Standard" originally had an effective push-pull output system but that was before three of the four cathodes became useless due to heater troubles! There were other things wrong, too.

After 20 years of service, I could have excused the old 58 for being worn out, but a check with the meter showed that the trouble was a complete lack of plate voltage, although the high tension circuit was intact to the RF coil.

Confound it all! There was obviously an open-circuited primary on the RF coil.

Well, I levered the can off the old tripod former to discover not just two loose ends, but six, indicating some rather potent corrosive action.

The next half an hour was spent in removing the coil and painstakingly unwinding three separate turns to give me enough wire to rejoin the ends. Meanwhile, the pot of paraffin wax was melting over the gas ring (with rather effluvious effect). Having made sure that the coil was now continuous, I dipped the former end—first into the hot wax and left it to froth and bubble freely.

After draining and cooling, the coil had a thin, but substantial coating of wax all over.

WORKING AT LAST

This time, the set worked, and, after alignment, reminded one of the RF performance that some of these old 175 Kc jobs could turn on, old-fashioned coils and valves notwithstanding.

Later I took the set back, and, while screwing it into the cabinet, explained to the lady in question that it had really been in a bad way. In suitable non-technical language I pointed out:

(1) The rectifier had gassed itself to a standstill.

(2) The output valves had only one doubtful cathode left out of a total of four.

(3) The IF transformer must have been hopelessly out of line with the unaccustomed shield can under its coat.

(4) The RF stage wasn't working at all due to faults in the RF coil.

(5) The alignment generally was a fair way off the beam.

By this time, I had plugged the set into the power point and was looking round for the aerial wire.

"Where's the aerial wire?" I inquired.

"Aerial? Oh, I've never had an aerial on it. Aren't they dangerous?"

I must confess that I understood the emotions which cause comic strip characters to be drawn with an exclamation mark above their heads, their feet off the ground and leaning over backwards at 45 degrees.

Changing the subject rather abruptly, I heard last week about

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1636-3H	200-220-230-240	300	80	2 x 6.3v-2A; 5v-3A	42/9
1332-9H	200-220-230-240	300	120	2 x 6.3v-2A; 5v-3A	53/3
1356-3H	200-220-230-240	400	150	5v-3A; 2.5v-5A; 6.3v-4A	70/-
1380-3H	200-220-230-240	450	200	2 x 6.3v-2A; 5v-3A	95/-
1371-8	200-220-230-240	500-600-750 850-1000	300		150/-
1400-19	200-220-230-240	565-500-425	250	2 x 6.3v-3A; 2 x 2.5v-3A; 5v-3A	110/-
1643-23	200 or 230 or 240	—	—	6.3v TAP 5v-2A (500v insul)	17/6
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973-21	30	20	80	370	500	25/9
012-1A	35	20	120	430	1000	35/3
967-1A	35	20	150	200	1000	46/-
956-1A	30	20	200	160	1000	57/9
011-1A	30	15	250	160	1000	59/6
783-1A	25	20/5	30/300	90	1000	65/6
986-1A	15	10		60	1000	62/6

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893-23	5000, 7000	2, 3.7, 8, 12.5	1	*40-15,000	5	SINGLE 6V6G, 6AQ5 ETC, TO VC	28/3
894-23	500	2, 3.7, 8, 12.5	2	50-10,000	5	LINE TO VOICE COIL	26/3
900-22	2500, 5000	2, 3.7, 8, 12.5, 15	1	*40-15,000	15	SINGLE 807, EL34 ETC. TO VC	57/6
896-9	8000, 10,000	2, 3.7, 8, 12.5, 15	1	30-15,000	15	PP 6V6G's A OR ABI TO VC	62/6
897-9	8000, 10,000	100, 125, 166, 250, 500	1	30-15,000	15	PP 6V6G's A OR ABI TO LINE	62/6
763-9	3000, 5000	2, 3.7, 8, 12.5, 15	1	40-20,000	15	PP 2A3's A OR ABI TO VC	62/6
809-26	500	2, 3.7, 8, 12.5, 15	1	50-20,000	15	LINE TO VOICE COIL	42/6
870-26	10,000	2 or 8	1	*20-20,000	6**	PP 6V6G's OR 807's AS TRIODES	57/6
871-9	10,000	2 or 8	1	*20-20,000	12	PP 6V6G's OR 807's AS TRIODES	81/-
872-9	10,000	3.7 or 15	1	*20-20,000	12	PP 6V6G's OR 807's AS TRIODES	81/-
891-22	6600	83, 100, 125, 166, 250, 500	1	50-12,000	35	PP 807's ABI TO LINE	82/6
892-22	3200	50, 62, 83, 125, 250, 500	1	50-12,000	55	PP 807's AB2 TO LINE	97/-

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563-6	600-60,000 OHMS	STALLOY CORE	200-5000 CPS	42/6

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518-6	20,000 TO 20,000 OHMS	SE OR PP	RADIOMETAL CORE	1:1 RATIO 30-10,000 CPS	69/-
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620-6	20,000 TO 180,000 OHMS	SINGLE ENDED	RADIOMETAL CORE	1:3 RATIO 30-10,000 CPS	69/-

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a case that is worthy of repetition, even though I don't know personally the parties involved.

It seems that somebody had a mantel receiver of unspecified brew, which had developed the bad habit of drifting off tune. According to the reports, it would be tuned to a station when switched on, but the station would thereafter appear to drift along the dial enough to require frequent retuning.

After a few minutes, it would apparently start to drift back the other way, ending up somewhere near or beyond the original dial setting.

The reason for this was not immediately obvious, but one could hardly believe that a design would be so bad in the first instance that a whole line of sets would be released which behaved in this fashion.

HUM WAS HIGH

At the same time it was clear that the original electrolytic condensers were in need of replacement, presumably because the hum level was high. These condensers were accordingly replaced and the set tested again. The hum had disappeared to be sure—but so also had the tendency to drift! The set now seemed as stable in this respect as any other.

A fellow technician, who was apparently consulted in the matter, suggested that, since the electrolytics were apparently weak, "some of the oscillation from the converter was penetrating the condensers and resulting in drift."

This sounded very much like a garbled report on what might have been originally a "left-handed" explanation.

Putting two and two together, I rather guess that the set was one in which the oscillator plate was running direct from a low voltage supply line, together with all other plates and screens, except, possibly, the output plate. This line would normally have an 8 mfd electrolytic to earth, with no parallel paper bypass if the manufacturers were out to save a few pence.

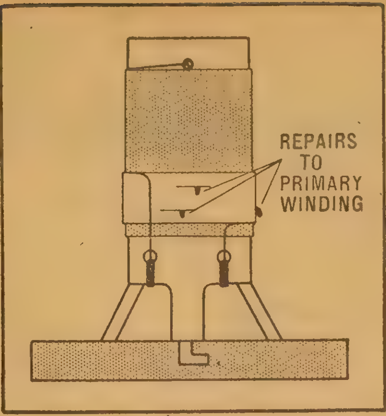
As the electrolytic aged it would become less and less effective as an RF bypass, and its effectiveness, too, might be subject to slight change as the set was switched off and on again. One could thus visualise the oscillator coil secondary being bypassed to earth through a rather uncertain and variable condenser. Hence the drift.

WORTH REMEMBERING

As I said before, I am relying on second-hand information, but the story has a novel and certainly feasible ring about it. The hint about the oscillator bypass might be worth remembering next time you strike a set which is given to this disconcerting habit.

To change the subject rather abruptly back to my own observations, I had occasion recently to use what would be the radio serviceman's equivalent of the medico's "shock treatment."

A customer brought along an ordinary looking 4-valve mantel superhet, which obstinately refused to receive stations. For a radio set, I admit that's rather a serious matter. He was in quite a hurry for it and I promised to get it through the same day if possible.



Not just one but three separate breaks in the primary winding of the R.F. coil had to be repaired. The coil was later waxed to hold the windings firm.

Being an easy matter, I slipped the set out of the cabinet and, as a first operation, turned the volume full on and touched a moistened finger on the centre lug of the volume control. This produced a reasonable sort of a hum, indicating that the audio section was at least not completely dead.

With two stages of audio, as in a 5-valve set, such a test would have produced a very loud howl of protest and one learns to judge how soft or loud the response should be.

SIGNS OF LIFE

Next I slipped the grid cap off the 6AR7-GT and noted that touching the cap on to the grid made a clicking sound.

The same test produced a clicking sound from the cap of the 6A8-G converter, showing that the set wasn't completely dead in these stages either.

By this time, of course, I was pretty certain that the trouble was in the oscillator section and, to prove the point, I first measured the potentials around the converter socket. Plate, screen and oscillator anode, all had the expected volts on their pins, but there was no suggestion of the slight backward kick that one usually gets when the voltmeter is touched on to the oscillator grid.

Academically, you should unsweat the oscillator grid leak and measure the current at the cathode end but it is always a messy procedure.

Instead, by way of verification, I clipped the voltmeter on to the screen pin and shorted across the oscillator gang. If the oscillator is indeed working, it generally makes quite a difference to the screen current when the gang is shorted across and, therefore, to the measured screen voltage.

In this case, the screen voltage was completely unaffected by shorting the oscillator section, indicating pretty definitely that the oscillator was out.

All this may sound something of a rigmarole but it is the kind of thing one does more or less automatically in less time than it takes to tell.

The obvious step would have been to plug in another converter but, as fate would have it, there wasn't another set handy around the place that had anything like a 6A8-G in the converter stage—and it was one of the types I had overlooked to order. (I must be slipping.)

WINDINGS IN ORDER

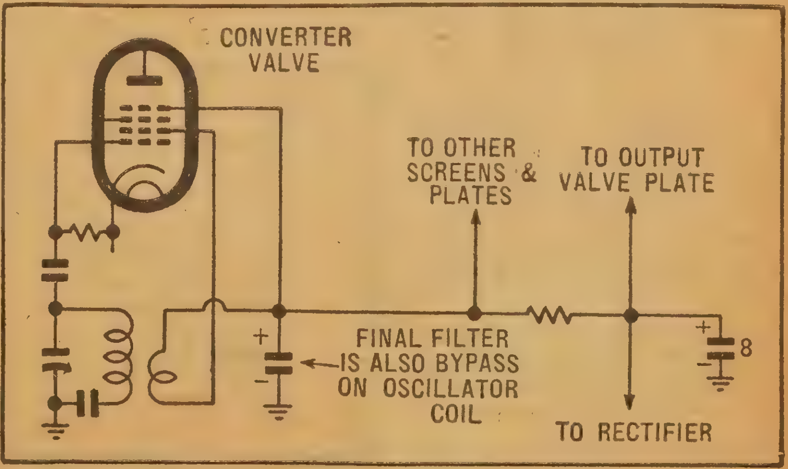
Anyhow, it could have been the coil or a short across the trimmer but a few moments with the multimeter cleared these components. There was no short to earth anywhere in the tuned circuit and, on the low ohms range, the secondary read 6 ohms and the primary 2 ohms, showing that neither winding was shorted out.

Well, then, what could prevent an oscillator valve from working that apparently had normal emission? Answer, an internally open or shorted grid. Perhaps a little shock treatment would help?

I cupped the left hand around the glass envelope and tapped very firmly with the ball of a couple of fingers on the glass envelope. There was a sudden crackle and the valve came to life. In fact, after that, I couldn't stop it.

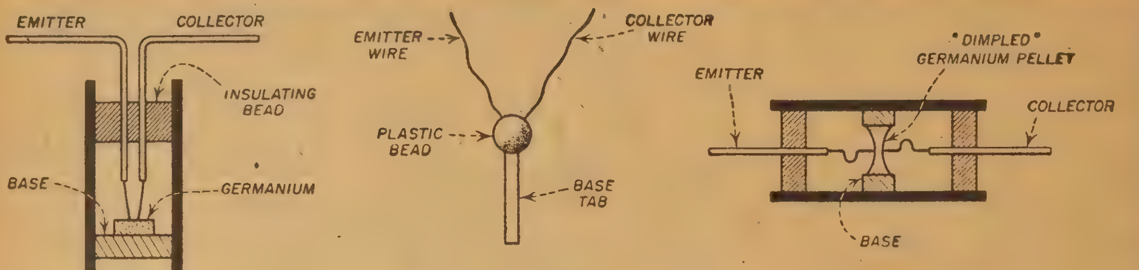
Fortunately, the valve was in a readily accessible place so I merely put the set back into its cabinet and hastened to "tee up" the supply of another one.

Maybe the valve would have worked satisfactorily for years but there's no point in taking risks when you don't have to.



Tuning drift in this set was apparently bound up with the fact that the failing final filter condenser was also serving effectively as the oscillator bypass.

RECENT TRANSISTOR RESEARCH



(a) Type A Transistor (b) Bead Transistor (c) Coaxial Transistor

FIG. 1

Within a few years, as transistors come into general use, radio enthusiasts will have to embrace a completely new concept of current-sensitive rather than voltage-sensitive amplifiers. This article, by engineers of the Aerovox Corporation, sums up the transistor position to date and explains ideas and applications which must ultimately become commonplace.

After only a few short years of intense development, the transistor has emerged from the category of a "crystal ball" innovation to assume the important role predicted for it by the great research organisations which fathered it.

Standardised types of transistors have come into being, and many developmental commercial and military equipments have been completely "transistorised," a new term meaning the replacement of all vacuum tubes by semiconductor diodes or triodes.

Although many technical problems still remain to be solved, and the semiconductor triode is still in its infancy, the only factor which prevents its wholesale appearance in hearing aids, midget radios, intercommunications equipment, telephone amplifiers, and many other applications at this time is the problem of availability.

When transistor production reaches the point where the supply is sufficient to meet the demand, the man in the field may awaken one day to find himself confronted with the unfamiliar circuitry of the transistor. This article is intended to help its readers meet this eventuality by presenting a condensed review of the present transistor art.

EARLY TYPE

The transistor introduced originally was known as the *point contact* type, later designated Type A. The configuration of this type is the familiar double "cat whisker" arrangement shown in Fig. 1a.

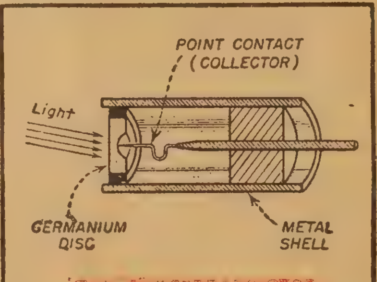
Two fine wire probes are arranged in contact with the surface of a pellet of germanium semiconducting material at points only a few thousandths of an inch apart.

One of the contacts is designated the "emitter," while the other is called the "collector." The semiconductor block and the metal which provides the electrical connection to it are called the "base."

The defects which characterise it are difficulty of construction, low power handling capabilities, poor noise characteristics, and undue temperature sensitivity.

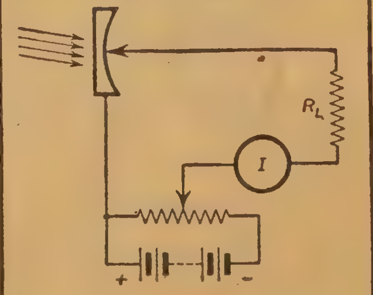
At least the first two of these shortcomings are due to the fact that the points of contact with the germanium must be very accurately spaced and are extremely small areas. For this reason, even a few milliamperes flowing through these contacts represent current densities of many amperes per square centimeter.

The excessive noise, which in instances exceeded 70 decibels above that predicted by theory, and the temperature dependance, may be inherent properties of semiconductors, although subsequent types have been vastly improved in these respects.



THE PHOTOTRANSISTOR

FIG. 2



SIMPLE PHOTOTRANSISTOR CIRCUIT

FIG. 3

A variant of the standard Type A transistor is the "bead type" transistor illustrated in Fig. 1b. This form is a minaturised version of the Type A which has been reduced to its very small size by eliminating the capsule and other non-essential parts.

The two phosphor-bronze contact wires and the small germanium block, along with a base contact tab, are "potted" in a small bead of insulating material which maintains the proper contact spacings. Bead types have been standardised which compare favorably with the larger sizes in performance. They are useful in applications where extreme miniaturisation is necessary.

THIRD FORM

A third form of the point-contact transistor is the coaxial configuration illustrated in Fig. 1c. Here the two "cat whiskers" make contact with opposite sides of the semiconducting germanium material where it is very thin—about .003 to .005in.

This thin section is produced by grinding the opposite sides of the pellet to the concave shape indicated in the figure. In this manner, the problem of maintaining the close spacing of the wires is somewhat alleviated and the tendency of the point of contact to slip sideways, as in the Type A construction, is minimised because the wires are coaxial and perpendicular to the surface of the semiconductor.

Another advantage of the coaxial construction shown in the figure is the fact that the emitter and collector are electrostatically shielded from each other by the semiconductor and the metal shell.

Although comparable in performance, the coaxial transistor does not seem to have found such widespread usage as the Type A transistor as yet.

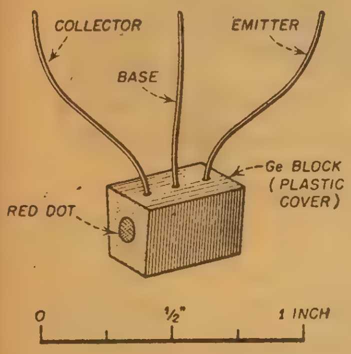
An extremely useful by-product of

the coaxial embodiment of the point contact transistor is the phototransistor illustrated in Fig. 2. This device makes use of the fact that the conductivity of germanium is altered by incident light energy, i.e., germanium is photoconductive.

This property makes possible a very small photocell built like the coaxial transistor, except that the function of the emitter electrode is performed by a beam of light which strikes the semi-conductor surface opposite to the one which the collector contacts.

The germanium must be ground very thin at this point, as in the coaxial transistor, otherwise, the "holes" liberated by the impinging light energy would recombine with stray electrons before being collected by the collector.

This electrode is biased negatively, as indicated by the simple phototransistor circuit of Fig. 3, so that it will attract the positive "hole" carriers.



A JUNCTION TRANSISTOR

FIG. 5

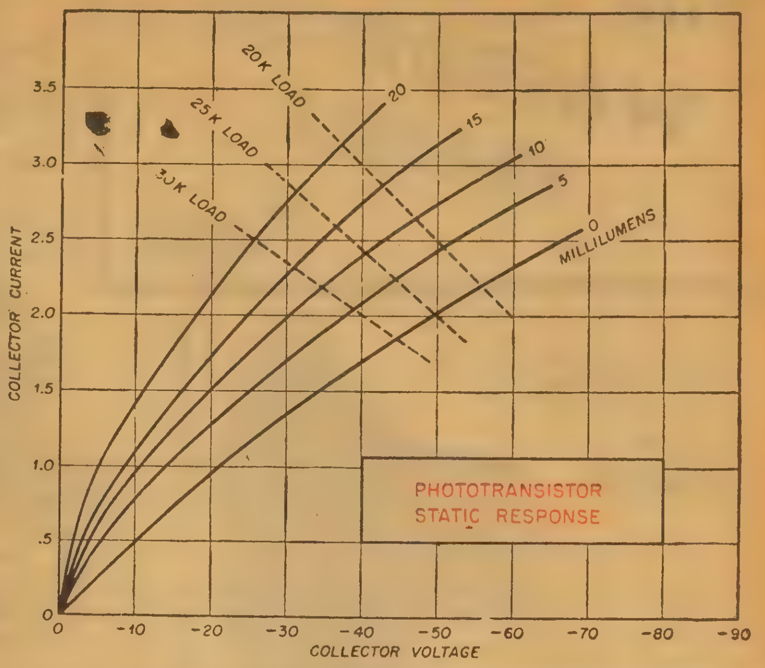
The response curve of the phototransistor peaks in the infra-red wave-length region (around 1 micron) but also shows satisfactory response in the visible light portion of the spectrum.

A unique characteristic of the phototransistor is the small area of its light-sensitive surface. Only light falling on that portion of the dimpled germanium pellet immediately under the collector contact will result in an increment in output current. This spot is only .010in in diameter. Such localisation of the photo sensitive region should prove useful in many applications.

The response characteristics of a typical phototransistor operating into several different values of load resistance are shown in Fig. 4.

The most significant recent advance in the field of semiconductor devices was the introduction of the junction-type transistor. This new form of semiconductor triode immediately overcame several of the serious limitations of the point contact type and put the transistor within "striking distance" of many vacuum tube applications which the point contact varieties had fallen short of fulfilling.

The physical appearance of the junction transistor is shown in Fig. 5. It differs from the point contact type in that the rectifying barrier layers are formed by boundaries or junctions between different types of germanium semiconducting material.



PHOTOTRANSISTOR STATIC RESPONSE

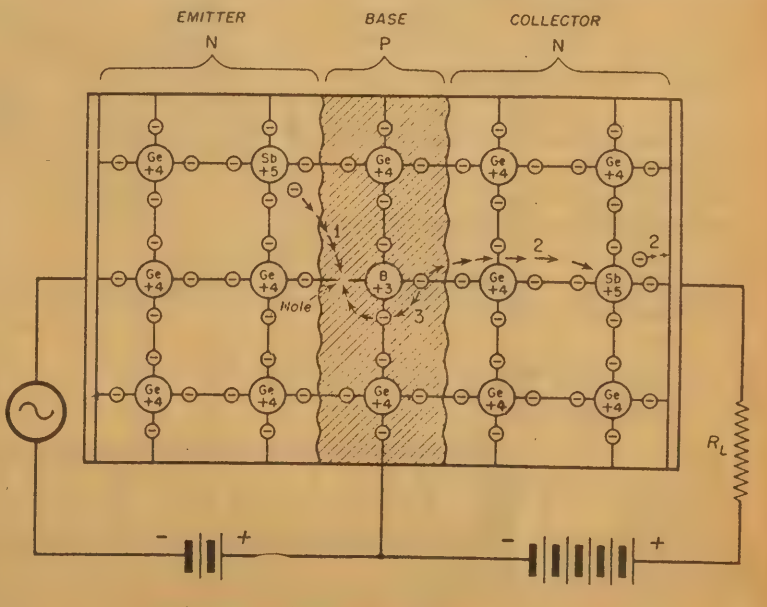
FIG. 4

The junction transistor is a "sandwich" of a thin layer of p-type germanium between two layers of n-type, or vice versa. The three layers must be in very intimate contact; the best results being obtained when all three are formed in a single crystal of germanium.

Most of the difficulty of fabricating junction type transistors arises in controlling the thickness of these layers, especially the centre (p-type) one which may be only .001in thick, and in attaching wire leads to them. The transistor is called an "n-p-n" junction type if the layers occur in that order, or a "p-n-p" type if the reverse is true.

In the n-p-n kind, which we will discuss here, the thin layer of p-type material is considered the "base," while the n-type germanium on either side are designated the "emitter" and the "collector."

The difference between n-type and p-type semiconducting materials results from the nature of the impurities present in the otherwise pure semiconductor crystal structure.



ILLUSTRATING ACTION OF JUNCTION TRANSISTOR

FIG. 6

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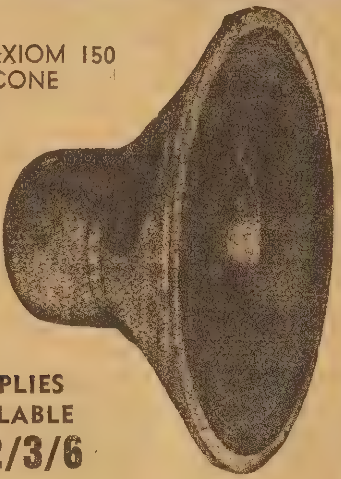

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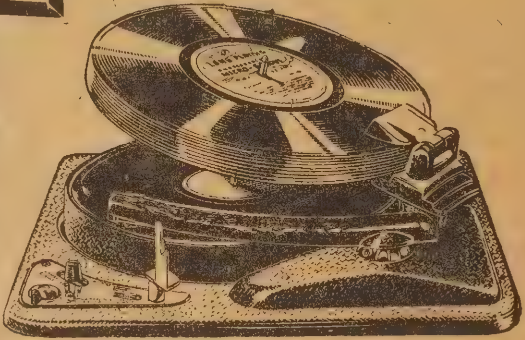

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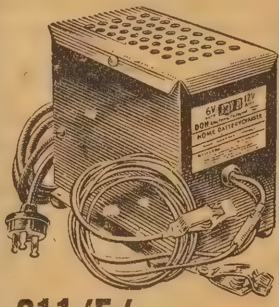

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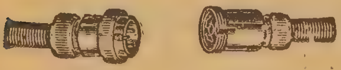

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For example, in the case of germanium, if only impurities having five valence electrons are present to form electron-pair bonds with the four valence electrons of the germanium atoms, the result will be n-type germaniums since the "left-over" electrons are free negative carriers. Such pentavalent impurities are antimony, arsenic and phosphorus.

On the other hand, if the impurities present are elements which have only three valence electrons, such as gallium, boron and aluminium, the resulting semiconducting is termed p-type. This is because the three valence electrons leave defects, or "holes" in the electron-pair bonds with the tetravalent germanium atoms.

These "holes" behave like positive charges migrating through the germanium crystal and are attracted to a negative electrode.

It is more difficult to understand the functioning of a junction transistor than the point contact type, since the basic mechanism involved is somewhat more complicated.

HOW IT WORKS

Some idea of its action can be gained by a careful study of Fig. 6, which shows not only the external circuits involved, but also the highly simplified internal structure of a hypothetical junction n-p-n junction transistor in which the p-layer is only one germanium atom thick.

In this example, one impurity atom of the proper valence is indicated in each of the three layers. In actual practice the ratio may be of the order of one impurity atom for each 10-million germanium atoms for proper transistor action.

Note that the polarities of the applied potentials are opposite to those used with the n-type point contact transistor and are more similar to the connections made in conventional vacuum circuits.

With the circuit connections shown, current flow in the collector circuit depends upon the availability of free electrons from the base, but since this material is p-type, it has no n-carriers to offer. In other words, the collector is biased in the reverse direction and the base-collector impedance is very high; it is sometimes as much as 10 megohms.

The emitter circuit, on the other hand, is biased in the forward direction so that the base must be made only a fraction of a volt positive in order to cause the free electron (in our vastly simplified example) to flow from the n-type emitter material into the base region.

CAUSES UNBALANCE

How this electron (or one just like it) can diffuse into the collector region may be visualised by assuming that when it flows across the n-p barrier, it fills the "hole" in the boron impurity atom. This "hole" was on the n-p side of the boron atom near the barrier since it was attracted by the negative potential of the emitter and repelled by the collector's positive charge.

When the emitter electron fills the defects or "hole," it weakens the hold which the nucleus of the boron atom has on one of the valence electrons on the collector side of the atom, since the positive charge of the nucleus is only three and it cannot retain more than three electrons effectively.

This electron is thus pulled out by the collector potential and flows into the collector, which then migrates back to the emitter-germanium.

This creates another hole in the other side of the base and is thus again in position to "ferry" another electron. Thus, for each electron which flows from the emitter to the base, one is freed to flow from the base to the collector.

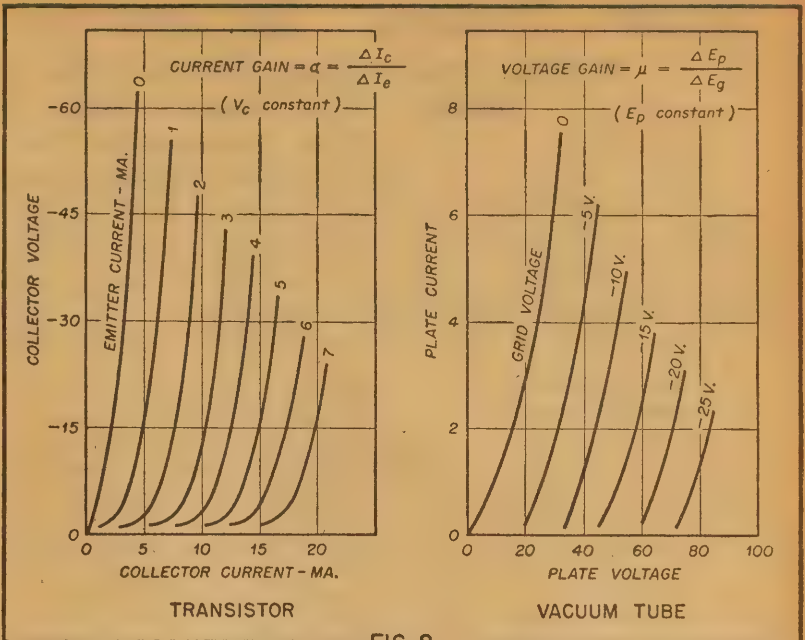

FIG. 8

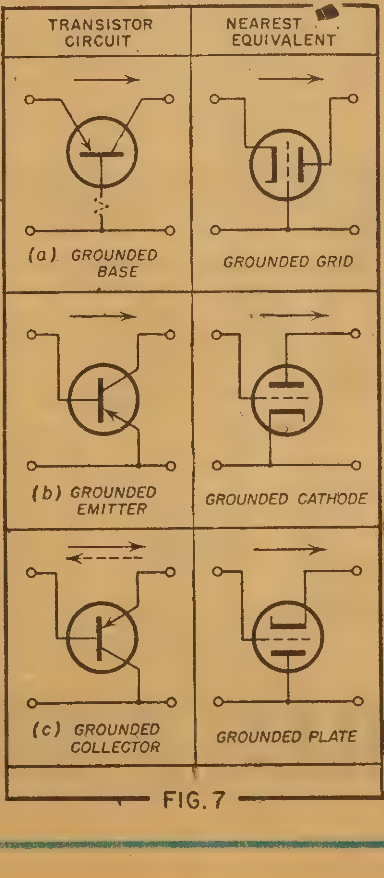

FIG. 7

For this reason, the current gain factor, alpha, never exceeds unity in a junction transistor. Very high power gains are possible, however, because of the very high ratios of output circuit to input circuit impedance.

The outstanding characteristics of the junction transistor are lower noise figure, higher efficiency, higher gain, and improved power handling capabilities. Its most unique feature is its ability to operate with good efficiency at extremely low power levels—in some cases as low as a few tenths of a microwatt.

The frequency limitations of the junction transistor may be more severe because of the increased capacitance of the bulk-type junctions.

BASIC CHARACTERISTICS

The three possible ways a transistor can be connected to function as an amplifier are compared with their nearest vacuum tube analogs in Fig. 7. The transistor symbol used here has been adopted to represent transistors of both the point contact and junction varieties. The emitter is distinguished by an arrow head and the base is represented by a straight line.

Each of the three basic transistor circuits, like its vacuum tube counterpart, has certain characteristics not exhibited by the other two. These may be summarised briefly as follows:

(a) The Grounded Base Circuit compares most favorably with the grounded grid triode tube circuit since the input impedance is low, the output impedance is high, and there is no phase reversal through the amplifier.

Typical input-output impedance

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U40/325	40	325/325	,,	,,	Upright	55/8
F40/325	40	325/325	,,	,,	Flat	,,
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F50/225	50	225/225			Flat	,,
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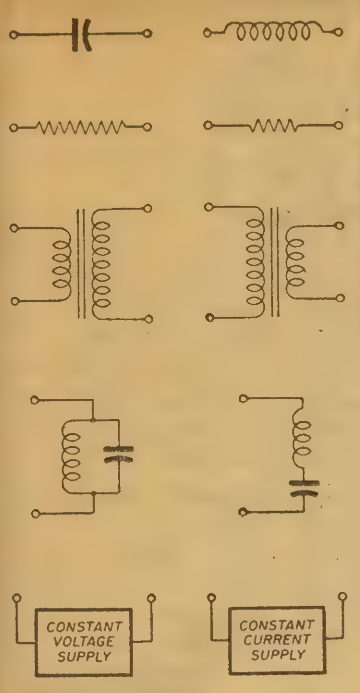


"DUALS" OF SOME COMMON CIRCUIT ELEMENTS

FIG. 9

ratios in this circuit would be 400:20,000 ohms for the point contact transistor and about 100:10-million ohms for the junction type. Power gains are moderate; about 16-18 db for the Type A and 50 db for the junction variety.

The operating stability of the grounded base circuit is limited by the base resistance, indicated schematically in Fig. 7a by dotted lines. Current flowing through the resistance of the germanium base material produces a regenerative feed-back voltage which can cause oscillation at high gain.

(b) The Grounded Emitter Circuit is closely analogous to the triode grounded cathode circuit. The impedance is higher than in the grounded base circuit, and the output impedance is lower.

Typical values of input impedance are 1000 ohms for the junction unit and about 2000 ohms for point contacts. The output impedances are about 1 megohm and 10,000 ohms respectively. A phase reversal does take place between input and output, as in the corresponding triode circuit.

STABILITY PROBLEM

Higher power gains are obtained in the grounded emitter circuit, being about 23 db for the point contact transistor connected in this manner and in excess of 50 db for the junction type.

Circuit stability is somewhat worse than in the grounded base circuit since the common feed-back element is now the emitter resistance instead of the base resistance. In point contact circuits, the current gain (alpha) must sometimes be reduced to near unity to prevent oscillation. This is not necessary in the junction type unit, since the current gain is inherently less than unity.

Noise and power handling characteristics are similar to those of the grounded base circuit.

(c) The Grounded Collector Circuit has properties similar to the grounded plate "cathode follower" triode circuit. No phase reversal takes place and the output impedance is considerably lower than the input impedance.

Input and output impedances are interdependent. Input impedance for the point contact case may be of the order of 40,000 ohms with a corresponding output value of 5000-10,000 ohms. The step-down ratio for the junction transistor may be even greater—4500 ohms to as low as 25-30 being possible.

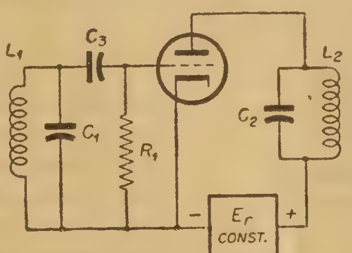
LOW POWER GAIN

As in the cathode follower, the power gain in the grounded collector circuit is low. Figures ranging from 10 to 15 db have been reported for the point contact transistor, and up to 17 db for the junction type.

A unique property of the grounded collector transistor occurs when the current gain factor is allowed to exceed 1, which is common in Type A units. Under this condition, the amplifier may become bidirectional, amplifying signals going in either direction.

The most useful tool which has been used in the development of transistor circuits is the principle of duality. By the employment of this technique, standard vacuum tube circuits may readily be "extrapolated" to transistor circuits having similar properties.

The basic concept in duality is that the transistor is a current operated device rather than a voltage operated device like the vacuum-tube. Therefore, replacing circuit elements having certain voltage characteristics in the standard vacuum tube circuits



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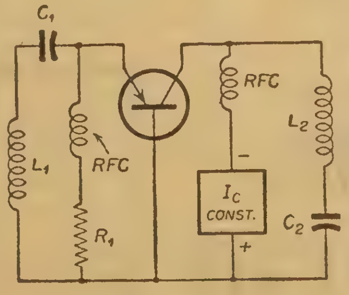

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FIG. 10

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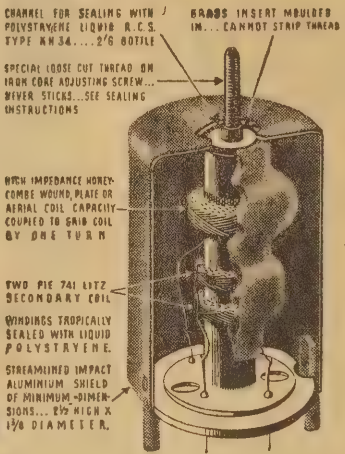
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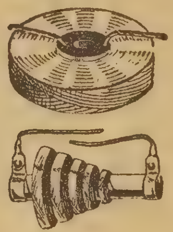

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with elements having similar current characteristics, and vice-versa, will lead to a circuit which functions well, in a surprising number of cases, when a transistor is substituted.

This interchangeability of voltage and current functions is quite graphically illustrated in Fig. 8, where the static characteristics of the triode and the transistor are compared.

Note that emitter current bias replaces grid voltage bias, collector current replaces plate voltage, and collector voltage is interchanged with plate current. Note also that the voltage gain factor of the triode (mu), the ratio of plate voltage change to grid voltage change, has been replaced in the transistor characteristic by alpha, the ratio of collector current change to emitter current change.

Some of the common circuit elements and their corresponding duals are compared in Fig. 9. Note that in each case the role of current and voltage are interchanged.

The dual of a capacitor, for example, in which the current is proportional to the time rate of change of the impressed voltage, is an inductance, in which the voltage drop is proportional to the time rate of change of the current.

Similarly, the dual of the conventional parallel resonant circuit used for tuning in vacuum tube circuits (because it develops high impedance and voltage) at resonance, is a series resonant circuit in transimpedance (passing high current) at resonance. Likewise, the dual of a voltage step-up transformer is a current step-up transformer.

As an example of the use of the duality technique, suppose that it is necessary to convert the standard tuned-plate, tuned-grid vacuum tube oscillator of Fig. 10a.

To do this by duality, the circuit elements of Fig. 10a would be replaced by the corresponding dual circuit elements shown in Fig. 9. The parallel resonant combinations L1, C1 and L2, C2 are replaced by low impedance series resonant circuits, the d.c. bias blocking capacitor (C3) is replaced by the r.f. blocking inductance (RFC) the high grid bias resistor (R1) would be replaced by a low resistance, and the constant plate voltage supply would be replaced by a constant current collector supply.

The resultant transistor circuit is shown in Fig. 10b.

ELECTRONIC TELESCOPE

(Continued from Page 9.)

The present apparatus is set up on the Petit Coude in the Paris Observatory, which has an aperture of 26cm only. The photocathode is a disc with a diameter of 25 cm.

The authors have obtained a great number of photographs of the heavenly bodies. Saturn and its ring were photographed much more clearly in a fiftieth of a second by the electronic method than by the fastest plate in ten seconds.

The standard of the negatives, the authors say, is exceptional on account of the excellent contrast, the total absence of fog on the negative and the absence of grain.

Says M. Lallemand: "If we can adapt this photon receiver to the demands of astronomical observations, it would enable us to push the limits of the accessible universe ten times further."

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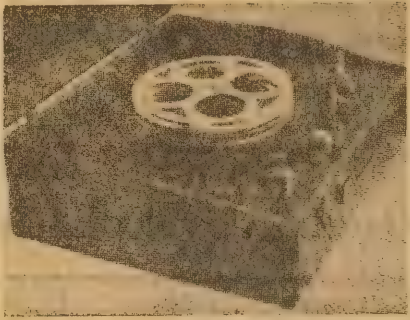

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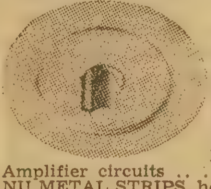

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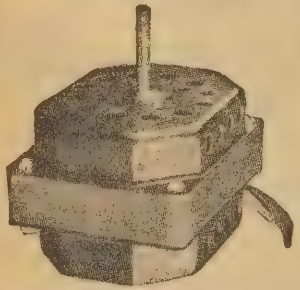

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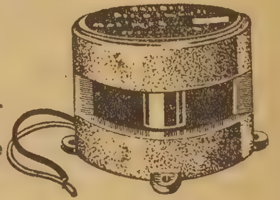

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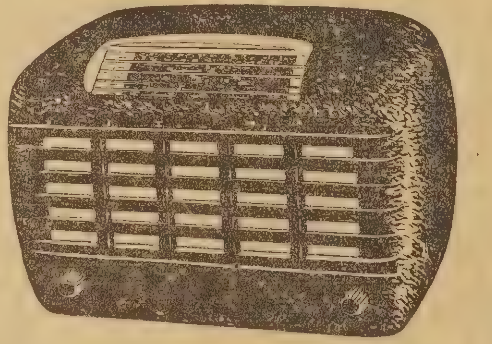

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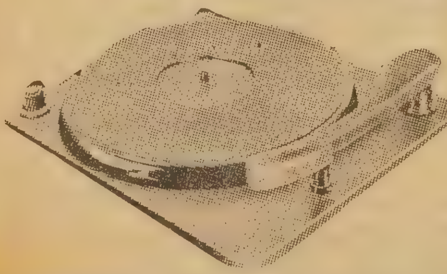

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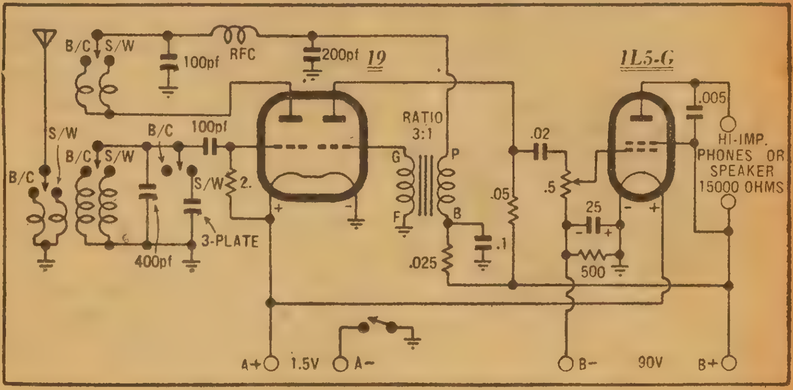
A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

EXPERIMENT WITH THESE SIMPLE BATTERY SETS

Some beginners like to commence their constructional experience in the radio hobby with battery-operated sets because it enables them to "find their footing" without the possibility of an electric shock. Here are two simple circuits which, besides handing out experience, can provide hours of entertainment.



THE circuit design on the right comes from Mr. J. F. Stephens, of 1 Dalgety St., West Brunswick, Victoria.

To quote our contributor's own words, "this set works very well on the broadcast band. I live four miles from Melbourne and I can at any time receive 3GL Geelong (Vic) at very good strength on a 10-inch speaker as well as all the Melbourne stations. At night I receive most of the South Australian and New South Wales stations, but these give better listening on phones.

SHORT WAVE

"The set also works well on the short-wave bands. On different coils I can receive about eight or nine stations as well as plenty of Australian and American amateur stations

"With a loop aerial fitted into the back of the set I can receive all the Melbourne stations at quite good strength. I have arranged the set so that I can take it anywhere in the house as a portable."

Although the valves used are rated at 2 volts on the filament, they will work OK with a 1.5 volt filament supply. The drain on the battery will probably be a little greater than with the 1.4 volt valves, but it is no trouble to place two torch cells in parallel. Of the 1.4 volt types, a 1G6G could replace the 19 without any circuit change. For that matter, a 3V4 could replace the 1L5G if the back-bias resistor is raised from 500 ohms to 700 to 750 ohms.

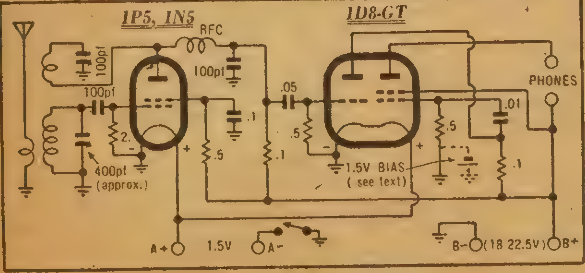
The coil switching should not prove difficult. A standard 4-pole 3-position switch could be used, giving one position for "broadcast" and two positions for two short-wave coils. A good picture on how to wire such a switch is given in the Teach Yourself Radio (6) of the February 1953 issue. Here a slightly different switch is used so that both ends of the reaction winding can be switched. You will not be able to do this here as one pole of the switch is required to switch the 3-plate trimmer for short-wave bandspread tuning.

If you want to avoid switching, use plug-in coil formers, one for the broadcast band and one or more for the short waves. Bases of discarded valves can be used as plug-in formers for some of the short-wave coils.

THE COILS

Although our contributor did not mention coil details, we could refer you to those given on page 81 of the December 1952 issue for the broadcast band and to page 29 in the February 1953 issue for a short-wave band of about 4 Mc to 15 Mc. Of course, you may have on hand a standard commercial Reinartz coil which you could use for the broadcast band. More complete information is given in a pamphlet entitled Coil Details For Small Receivers, which is available through the 27-Query Service.

Note that the 3-plate capacitor is brought into circuit on the short waves, where it acts as a bandspreading control for fine tuning. The main tuning capacitor acts as a band-set control and is used to select different portions of the tuning range.



Incidentally, portable loop details are given on page 37 of the March 1953 issue.

The second circuit design was submitted by Mr. T. Smith, of 34 Bay View Terrace, Mosmans Park, Perth, Western Australia. He describes the set as a "perfect portable for 'junior' when he goes camping."

It is constructed in a manner to fit a case 6in by 6in by 9in high, with the lower 3in of height used to house the phones when not in use.

The same coil details will apply as for the set described above, although our contributor used a commercial Reinartz coil with the aerial connected to the "short aerial" tap. For really portable use, the phones are connected to the set through a 5-pin plug, and the pin farthest away being used to connect the body as an aerial to the set.

YOUR BODY AN AERIAL

This is arranged by winding a fine wire around the phone cord and attaching it to a bare patch on the headphone band or a metal ear cup of the phones so as to make contact with the body. Mr. Smith says that he has had results up to 20 miles using the body as an aerial.

The high tension is provided by two 9-volt C batteries connected in series. The A battery was a 9-volt battery rewired to place all the cells in parallel. However, a standard 1.5-volt torch cell would do just as well. Without the 1.5-volt bias battery connected to the pentode grid circuit of the 1D8GT, the HT drain was .8 mA. With it in circuit, the drain was .5 mA. You can please yourself on this particular point.

Here's your answer, Tom!

With his usual admirable thirst for knowledge Tom asks another batch of questions on a wide variety of subjects. They range from questions about the operation of a radio-telephone system to open-circuit condensers and, finally, about bandspread on the short-wave bands.

THE questions aren't in any particular order and jump from subject to subject with gay abandon. That's all part of the character of Tom. At any rate, you will find plenty to interest you in the answers.

Here is the first one.

Could you please tell me how the head station operating a fleet of hire cars, taxis, police or ambulance cars fitted with radio-telephone can signal one of the cars that they require to speak to him?

Is it possible for the car to call the head station and do all sets operate on the same frequency?

We'll do our best to give you a summary, Tom, because it would take pages and pages to go into any detail.

Most of the radio-telephone systems operate on a single frequency which is assigned to them by the PMG's department. This means that it is not possible to speak and listen at the same time because a receiver and transmitter close together and on the same frequency would merely feed one into the other.

In practice a press-to-talk system is quite satisfactory when the operators become accustomed to using it. If you are a well-mannered person you would not want to talk while the other person is talking in any case.

"Taxi lady?"

Usually there is a button on the microphone and when you wish to talk to the other station you merely press the button and say your piece. When you release the button, your transmitter is switched off and your receiver is free to accept signals from the other party.

If the control station in a system wishes to call one of the cars he simply says, "XY2ZZ to car 16, come in please," or something similar, according to the operating procedure for the system.

All cars with their sets switched on will hear the message but only car 16 will reply. Unless some such system is used you'd have all the cars obeying all the messages with the due results imagined by our artist.

Likewise any one of the cars can call the control station if he wishes. The only snag is that within a given area, only one conversation can take place on the particular channel at any one time.

Some systems have a selective calling system in order that the driver of a particular vehicle need not be worried by calls not intended for him.

SPECIAL CODE

The receiver is operative all the time but its output is not switched through to the speaker until a particular code is satisfied. It may be a series of tones of different frequency or possibly a series of dots and dashes. Each receiver is arranged to respond to a different code.

It is possible to feed signals from a radio car into the normal wired telephone system and, in fact, this is done in some cities where the number of users is sufficiently great to warrant the expense of the equipment. With this arrangement it is possible to be switched through to any number in the telephone book and you can have your conversation while the car is moving if necessary.

The person at the fixed telephone uses it in the normal way but the person in the car must operate on the press-to-talk system.

Could you tell me what is the difference between 2 ohm voice coils and higher resistances? Is a speaker with a 15 ohm voice coil better than one with a 2 ohm voice coil?

No, Tom, the impedance of the speaker voice coil has little to do with its quality. It is largely a matter of design convenience. Just as a motor car with 27in wheels may or may not be better than a car with 17in wheels so a speaker with a 15 ohm voice coil may or may not be better than one with a 2 ohm voice coil.

Actually, by using thicker wire and fewer turns it would be possible to rewind a 15 ohm voice coil for a much lower impedance but with the same performance, provided a suitable matching transformer were used.

Manufacturers may find the lower voice coil impedances cheaper and easier to build. The higher impedances on the other hand are better where it is desired to instal voice coil filter circuits and also where it is desired to extend the voice coil leads over long distances.

The upper limit to voice coil impedance is reached when the wire becomes too thin and, therefore, liable to breakage.

If, without making any other alterations to a set, I connect an extra output valve similar to one already in the set in parallel, pin to pin (pin No. 1 to pin No. 1 on the new one and so on) what would be the result?

That's a very interesting question, Tom, and not at all obvious in its complete solution.

If the set obtains the bias for the output valves from a battery, the behavior of the two valves in parallel will be fairly simple to predict. The plate (and screen) current for each valve will be the same as before so that the total current drawn from the supply will be double. If the valves are operated into a load of half the original value, twice the power output will be available.

"Open circuit"

Even if you didn't halve the load resistance, there would be more power available, provided, of course, the extra drain on the power supply did not cause the supply voltage to drop. In most cases the power supply would be seriously overloaded, because receiver designers usually only allow a small margin in the power transformer and filter choke.

If the bias for the output valve is obtained by placing a resistor in series with the cathode, as is most commonly the case, the position will be somewhat more complicated. The increased drain through the resistor will cause the bias to increase. But the increase in bias will cause the plate current to decrease.

It's something like the story of the dog chasing its tail except that, in this case, the bias and plate current do finally accept a compromise and settle down at steady values.

These final values are intimately connected with the characteristics of the valve and in order to predict them it is necessary to consult the characteristic curves published by the makers.

TYPICAL CASE

We did this in the case of the 6V6-GT, one of the most popular of the output tetrodes. With 250 volts on both plate and screen and a 250 ohm bias resistor in the cathode circuit, the plate and screen current of the 6V6-GT is close to 50 mA. However, instead of 100 mA when the second valve is plugged in, the plate current rises to only 66 mA, assuming no change in voltage. A change would be inevitable, however, and the end result would be nearer 60 mA.

Our guess is that you would hardly notice the difference in the output with the extra valve in circuit. Even if you fitted a speaker transformer designed to reflect a slightly lower load, the difference in power output would be negligible to the ear.

If you require extra power output and the power supply will stand the drain, halve the bias resistor and the load resistance before connecting the two valves in parallel.

Of course, if you can provide some out-of-phase drive and a centre-tapped output transformer, the second valve can be connected in a push-pull circuit, with attendant advantages of reduced distortion, &c.

How can you have an open circuit condenser, when any condenser already presents an open circuit?

It sounds as though you are all tangled up in knots, Tom, and we really can't blame you because it does sound very confusing.

The key to the problem is to analyse what is meant by "open-circuit" in each case. You see, there are some cases when an open circuit is not an open circuit.

BASIC FORM

Fundamentally, a condenser is a pair of plates separated by some insulating material which may be air or one of the many other materials, such as mica, paper, oil, &c. If a battery is connected, one terminal to one plate of the condenser and the other terminal to the other plate, there will be a physical strain placed on the material between the plates or dielectric as it is called.

The dielectric, like all other materials, is made up of many millions of atoms. These atoms consist of positively charged particles called protons and small negatively charged particles called electrons. The arrangement of each atom is like a tiny solar system with the proton in the centre and the electrons revolving around it like planets around the sun. However, the particles are so small that you would not be able to see them, even on the most powerful microscope.

When you apply the charge from the battery to the condenser plates, the electrons, which have a negative charge, are attracted to the positive plates of the condenser and the protons to the negative plates of the condenser. Unless the battery voltage is very high, you won't succeed in moving the electrons from their orbit completely, but you will make them deviate from their normal path.

If you like, imagine the dielectric as a piece of rubber and the battery as a stretching force. If you stretch the rubber it will remain in tension until you release the force when the amount of energy you put into it in the first place will be released.

In the same way as the rubber stores the mechanical energy, a condenser stores electrical energy.

The larger the area of the plates and the closer they are together, the greater the amount of energy will be stored for a given voltage or, in other words, the greater the capacitance of the condenser.

TWO WIRES?

Taking the other extreme, if you place the ends of two wires close together, you will also have a condenser. However, there will not be many atoms within the electric fields at the ends of the wire and its energy-storing capabilities will not be very great.

Therefore, if you have a broken lead in an ordinary radio condenser, you have effectively placed it in series with another very small condenser. The effective value of the combination will actually be a little less than the value of the smaller condenser, so that the energy-storing capability of the combination will be very small. An open circuit condenser, if you like.

We remember reading in the newspapers recently about a well-known racing driver who got into serious trouble because of an open circuit. And it didn't have anything to do with condensers.

What is the smallest possible voltage I could use in the primary of a power transformer? I know that 6V is used sometimes, but what about 4V or 2V? If 6V is okay, I can't see why it could not be lower, but is that correct?

We haven't any idea why you wish to use a power transformer with a low primary voltage, so we can only answer your query in a general way. In practice, the problem would be modified by economic considerations.

However, theoretically, there is no lower limit to the voltage which can be applied to the primary. As the voltage goes lower, you have fewer and fewer number of turns of thicker wire. At very low values you may have only a fraction of a turn of thick busbar.

You will realise, of course, that for a given amount of power, the current flowing has to increase as the voltage is lowered. To put the idea in another way, you cannot gain power by using a transformer. It is merely a device to convert one form of electrical energy to another.

It would be wonderful if someone could invent a device to step up power in the same way that we can step up voltage. Connect a few such devices together and you would soon have enough power to work every factory in the country, so long as the torch battery lasted!

I recently bought a new receiver which has bandspread on the short-wave bands. However, I am disappointed because it doesn't tune as sharply as an ordinary short-wave set belonging to a friend. Could you please explain the reason?

We'd be glad to, Tom. It really isn't very difficult to understand and you needn't be worried about your set. The chances are that your set is just as selective or even more selective than your friend's.

The reason for including the bandspread in the first place is to make the set easier to tune. By arranging the mechanism so that the full length of the dial covers only the important short-wave broadcast bands instead of the usual 16 to 50 meters, the tuning is made much easier and it is possible to make a note of the position of a station with sufficient accuracy to be able to return to it later if you wish.

If the pointer happens to move a small amount from the correct setting in the case of your receiver, you will not lose the station altogether as would happen with your friend's receiver.

If there were a station, say, 5 Kc away from the station you desire to receive, it would be a good deal farther away from the desired station in terms of inches than it would be on your friend's set. But you would still have as good a chance of separating the two.

Selectivity and bandspreading are two quite different things. While selectivity is a measure of the ability of the receiver to separate stations close together in terms of frequency, bandspread is a measure of the amount of dial movement required to cover a given frequency.

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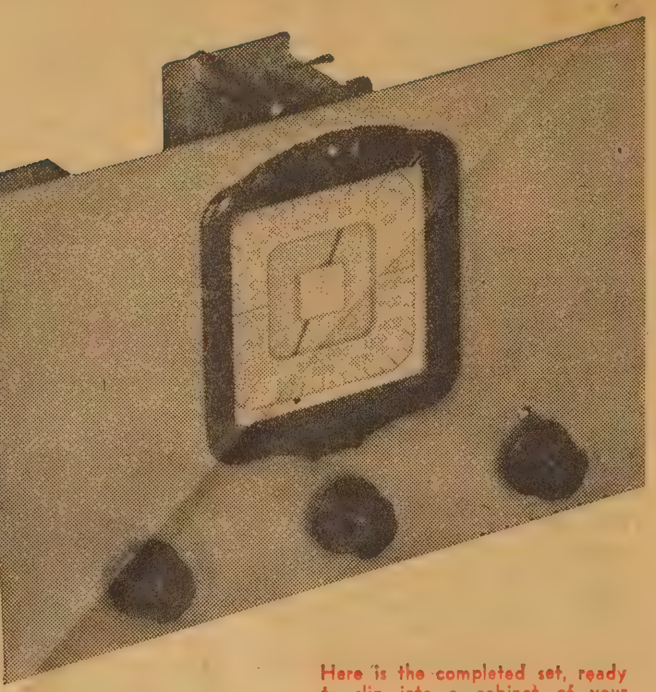
by Raymond Howe



Here is the completed set, ready to slip into a cabinet of your own making. Aerial, earphone and power connections are at the back. Power switch is at the left, reaction control in the centre and tuning at the right.

SINCE the completion of the "Learn While You Build It" series (March 1951 issue to July 1952) and the "Teach Yourself Radio" series (August 1952 to April 1953) we can come to only one conclusion — there is a rising generation which is keenly interested in the construction of simple sets.

A glance through our files shows that, over the past few years we have published a wide variety of designs for an equal variety of purposes, ranging from just as few valves to many valves.

THE INITIAL SET

There are very few sets, however, apart from those in the series mentioned, which are simple enough for the complete beginner and described in a single constructional article.

It is with this thought in mind that we present the 1953 "Little Jim" a simple 2-valve AC operated set suitable for the beginner, whether of schoolboy or adult age. The set can be operated on both broadcast and shortwave bands by plugging in appropriate coils.

The intended role of the set is to establish the fundamentals of radio operation and construction in preparation for attempts at larger and more complicated sets. It will also serve as an introduction to the thrills and vagaries of short-wave reception.

Having fulfilled its original purpose in life, the little set may well find its way into the son's bedroom where it will replace the bedside operation of the ubiquitous crystal set, with its necessarily limited capabilities.

Just what will this set do? Well, to begin with, you can be certain of loud earphone volume from all the local stations, if you live in a city area. You won't need a large aerial for this either, a few feet of wire being all that should be necessary in most locations.

In fact, if you use a larger aerial it might be necessary deliberately to reduce its effectiveness for local listening, in order to avoid excessive spreading and overloading from the local stations.

On parts of the dial not cluttered by local stations, or late at night, you will be able to hear plenty of country and interstate stations with a better aerial connected to the set.

OVERSEAS STATIONS

And short-waves? With about thirty feet of wire no more than eight feet off the ground, we tuned in straight away several local amateurs and quite a few of the stronger overseas stations at good phone volume.

With the detector oscillating weakly, literally hundreds of carriers could be heard, many of them sending morse at adequate strength for good copy. In fact, this little set is the easiest way we know of getting yourself some morse reading practice.

Had we taken the trouble to erect a more effective short-wave aerial, to choose an optimum listening time and a better pair of phones — the ones we used were old disposals low-impedance types — the reception would certainly have been even more impressive.

We put the set away with one definite feeling, however. There is a lot of fun to be had listening to and getting the best out of these little sets — the kind of fun that was the spice of life in the days when literally all beginners came up through the "Reinartz" stage.

As we have more or less inferred, the ultimate performance of this or any other small set depends on how carefully you adjust things and this is one of the valuable features from the point of view of training.

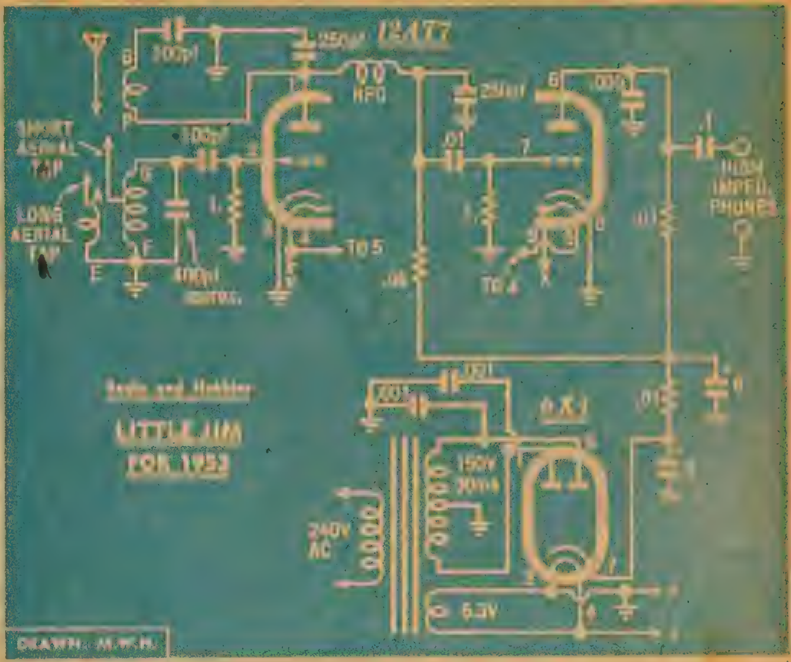
THE AERIAL

The aerial is most important. As we mentioned earlier, a few feet of wire is all that is necessary to receive the local stations at good strength but it is inadequate for distant stations or short-wave listening.

Ultimately, your best plan is to erect a fairly good outside aerial, 40 odd feet in length and as high as you can reasonably arrange. This will be excellent for long-distance reception, but the local stations may spread badly.

You can overcome this quite simply by arranging an extra terminal or switch on the wall or on the set—it doesn't matter where—

CIRCUIT OF "1953 LITTLE JIM"



The circuit differs from previous "Little Jim" receivers in that it uses an all-AC supply. No H.T. however appears on the headphones. The one-valve two-stage circuit follows along traditional "Reinartz" lines, favoured by beginners for the past thirty odd years.

and so wire it that a small value of condenser (from 10 to 50 pf) can be put in series with the lead-in for local station listening only. Some experimenters even like to have a small variable condenser in this position to allow the aerial coupling to be adjusted to any value at all.

In point of fact, we didn't even bother with a condenser. There was enough capacitance across the switch, when it was open, to feed local signals through!

But don't be put off with talk about aerial adjustments. It's just "fun" for the keen experimenter.

Then again, you can have more "fun" by adjusting aerial coupling when you wind your own coils. A slight increase or decrease in the number of aerial primary turns can have an important bearing on the performance of the set. We'll tell you more about that later.

Its all a matter of selecting a length of aerial and "pruning" the coils till you get the best overall balance between volume and selectivity. In other words, adjusting things till you can separate as many stations as possible and still have them at comfortable listening level

DESIGN PROBLEMS

Now, let's see what lies behind the electrical design of the set.

We felt that AC operation was an important point because, if the set was to serve as introductory groundwork for more pretentious efforts later, some confidence in the handling of AC power supply wiring should be provided.

Although the initial cost of supplying operating voltages would be somewhat higher than with battery operation, you don't have to worry about battery life and replacements. Furthermore, if you want to build another set, the power supply components can still be used.

For the set proper, we used a dual triode valve and the preferred type is the 12AT7—a valve having very high gain. However, with some sacrifice in performance you can use any of the 9-pin miniature types having a 12.6 volt heater or any of the octal-based types having a 6.3 volt heater.

Those with the 12.6 volt heater have a centre-tap brought out so that both halves of the heater can be wired in parallel for operation from the 6.3 volt winding on the power transformer.

HOW IT WORKS

We don't want to get too technical in the description of this set, but to give you a rough mental picture of what goes on this is briefly what happens. Starting with the power supply, the rectifier converts the 150 volts AC from the power transformer secondary winding into pulsating DC at the cathode of the rectifier.

The first 8 mfd electrolytic capacitor at the rectifier cathode tends to smooth the pulsations to some extent due to its "reservoir" effect. Additional filtering is provided by the following .01 megohm resistor and the second 8 mfd electrolytic.

The set draws current from the rectifier through this .01 megohm resistor, causing a voltage drop to appear across the resistor. This means that the voltage applied to the set is lower than that appearing at the output of the rectifier.

For instance, with one particular valve plugged into the set, we measured with a voltmeter about 210 volts at the rectifier cathode and about 150 volts at the other end of the .01 megohm resistor. This represents a drop of about 60 volts; and, by simple Ohms Law calculation, indicates a current drain of six milliamperes by the set.

If you are just starting off in radio, all this may seem a little heavy going, but don't worry about it. It has been mentioned for the benefit of those who have advanced a few steps already.

With the dual-triode valve, one triode section is used as a simple regenerative detector. Signal voltages from all of the "receivable" stations are present on the aerial which is coupled to the tuned circuit at the grid of this triode section.

TUNING THE STATIONS

This tuned circuit is an "acceptor" circuit, because, used in this way, it will accept only those signal voltages having the same frequency as that to which the circuit is tuned by the variable capacitor, the 400 pf single-section tuning gang. Thus, as the dial turns the tuning gang, the signal voltages from various stations are accepted by the tuned circuit.

At this stage we must bear in mind the little story about selectivity. If the aerial is coupled too tightly to the tuned circuit, it reduces the ability of the acceptor circuit to discriminate clearly between

PARTS LIST

- 1 chassis 8in x 4in x 2in with front panel 9in. x 6¼in.
- 1 power transformer 150V a side, at 30 mA.
- 1 single section tuning gang.
- 1 100 pf midget variable capacitor.
- 1 miniature Reinartz coil. 1 RF choke.
- 1 dial with 0-100 calibration included (MK17A or similar).
- 1 9-pin and 1 7-pin miniature socket.
- 1 6-pin standard socket, 1 phone jack.
- 1 2-pole on/off switch, wafer type, with insulated spindle.
- 3 6-pin 1½in dia. coil formers.

VALVES

1 6X4, 1 12AT7

RESISTORS

2 1 meg. ½w, 1 .05meg. 1w, 2 .01 meg. 1w.

CAPACITORS

2 .001 mfd mica capacitors, 2 8 mfd 350 or 525PV electrolytics, 1 .1 mfd 350VW, 1 .01 mfd, 1 .005 mfd, 2 250 pf, 1 100 pf.

SUNDRIES

3 knobs, 2 terminals (1 red, 1 black), 3-core flex and 3-pin plug, 2 ⅜in i.d. rubber grommets, 1 5-tag and 1 3-tag mounting strip, wire for coil winding, hook-up wire, spaghetti, solder lugs, solder, nuts bolts, &c.

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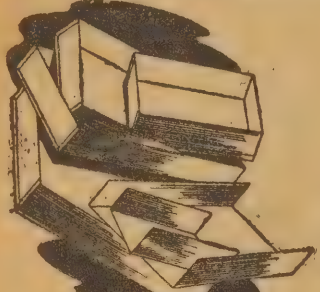

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13 x 10 x 2½ welded	3E14	17/6
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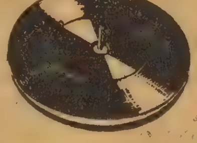

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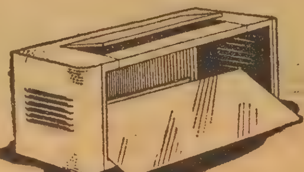

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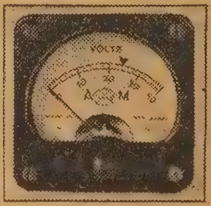

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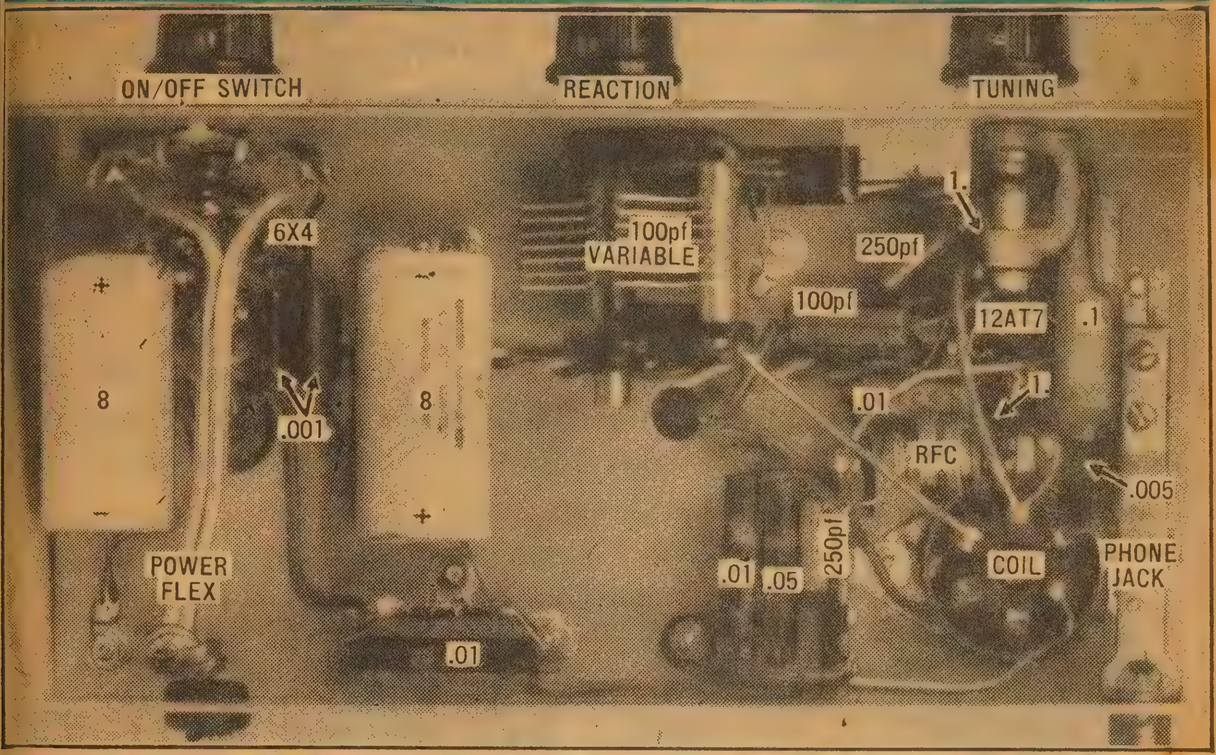
CLOSE-UP UNDERNEATH VIEW OF THE WIRING



You won't be able to pick out every individual wire in this underneath photograph but it does at least show the orderly array of components. Try to make your own wiring as neat and straightforward both for appearance and efficiency.

signals from stations which are close in frequency.

Accepting this point for the moment, the other action which takes place is regeneration, sometimes called "reaction." It works this way. The signal voltages which appear across the grid tuned circuit are amplified by the valve and appear in the plate circuit. A proportion of the amplified signal is fed back, however, through the reaction, or feedback, winding to the grid tuned circuit. The amount of voltage feedback is controlled by the setting of the 100 pf regeneration control, or reaction capacitor.

USING REGENERATION

If too much signal voltage is fed beck, the valve and circuit will oscillate and produce a whistle on the station tuned in. At the setting of the regeneration control just below where the circuit breaks into oscillation, the magnification and selectivity of the tuned circuit is at its best for a given amount of aerial coupling.

There is a difference of many times in signal volume obtained in this condition and when there is negligible regeneration, hence the advantage of a regenerative detector over other types.

The presence of the 100 pf capacitor and the 1 megohm resistor at the grid of the regenerative detector enable it to "detect" more effectively or to "de-modulate" the voice or music program transmitted on the station carrier tuned in. These audio voltages are also amplified by the detector triode and appear at the anode of this section together with the RF carrier voltages used for regeneration.

Generally speaking, the more voltage which we apply to the detector triode anode through the .05 megohm plate load resistor, the greater will be the amplification of the desired audio voltage. On the other hand, if we have too much voltage on the detector anode, the regeneration control will be very critical and the circuit is liable to squeal and growl disconcertingly as the set is tuned around the dial.

WE had hoped to prepare a complete wiring diagram for this little set but the time factor beat us. If at all possible, we will prepare a diagram for inclusion in the next issue.

To retain the former advantage and reduce the effect of the latter disadvantage, we use a bypass capacitor from the plate of the detector to earth to prevent all the RF voltage from passing through the feedback winding to the coil. From the point of view of regeneration, this has the same effect as operating the detector at a reduced voltage.

We have set the value of this capacitor at 250 pf for the particular valve and coils used. With lower gain valves the detector may not oscillate quite so readily, and it may be necessary to reduce the capacitor to 100 pf or even omit it altogether.

To take up the story again, however, although we have the RF carrier voltage and the demodulated audio voltages appearing at the anode of the detector, we wish to retain only the audio voltages. To do this, we insert an RF choke and an RF bypass capacitor between this point and the following circuitry. These components have negligible effect upon the audio component and this appears across the .05 megohm anode load resistor to be fed through the .01 mfd coupling capacitor to the grid of the second triode section.

This section amplifies the audio voltages, comprising the voice or music program, and presents them across the .01 megohm anode load resistor, where they are fed to the heaphones to be converted into acoustical energy to actuate our ears.

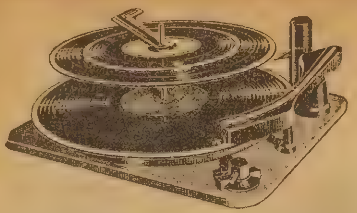
The .1 mfd coupling capacitor to the phones prevents the high tension DC at the anode being applied to the headphones. Primarily it is a safety measure.

RF FILTER

Just in case a small amount of RF voltage sneaks through from the detector anode, we place a .005 mfd capacitor from anode of the second triode to chassis to keep it out of the phone leads. It is a particularly important point on short waves.

For the purpose of illustration, assume that some RF voltage did find its way into the phone leads. If the phone leads happened to be close to the aerial lead-in, RF voltage may be coupled back into the input of the set and cause a continuous squeal in much the same manner as the controlled regeneration does in the detector circuit.

It is usual to provide a small



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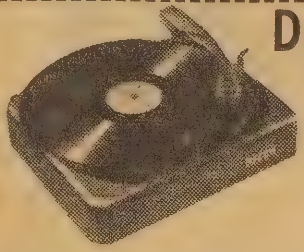

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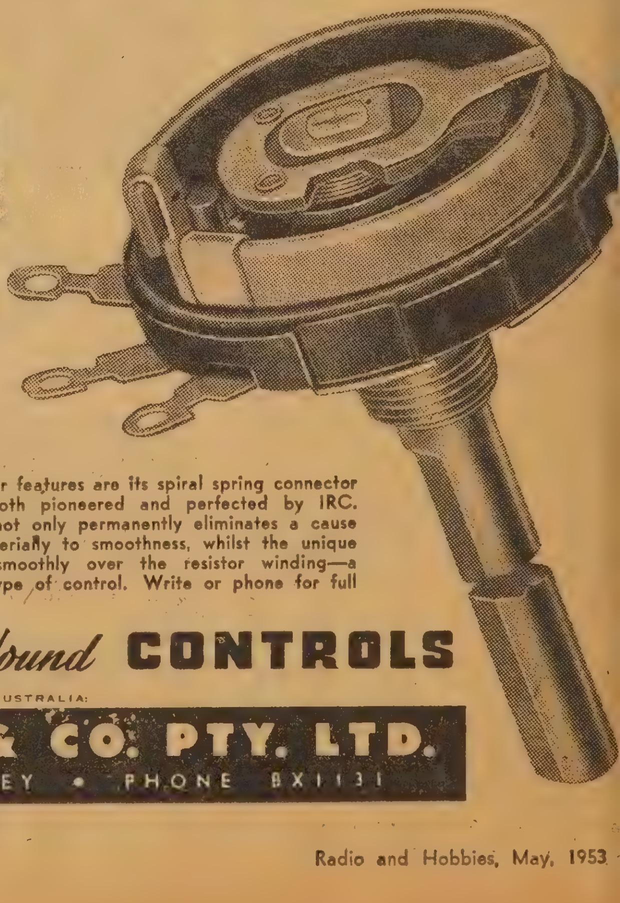

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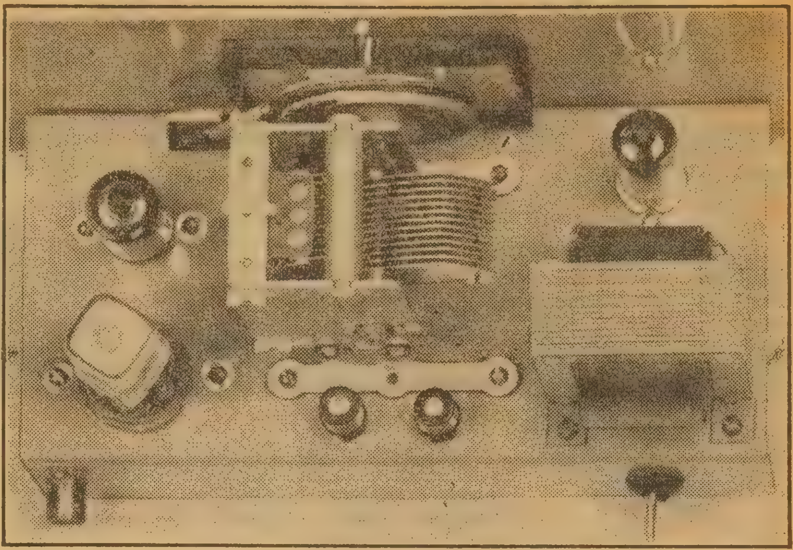
negative grid bias for a valve which is being operated as an audio amplifier. This can be extracted from the power supply and applied to the grid resistor but a more convenient method is to wire a bias resistor in the cathode circuit.

Without going into a long story, a resistor in this position makes the cathode slightly positive with respect to the grid, which is exactly equivalent, as far as the valve is concerned, to making the grid negative with respect to the cathode.

We started off by wiring in a cathode resistor but realised that the 12AT7 requires such a low value, and operates here with such a small plate voltage anyhow, that a bias resistor is completely unnecessary either to minimise plate current or to avoid distortion. In fact, the set sounds better without it!

The second cathode is therefore shown directly earthed.

A TOP VIEW OF THE RECEIVER



Looking down on top of the chassis. The detector/audio valve is at the left, the rectifier to the right. Aerial terminal (right) and earth terminal are obvious, as also are the tuning condenser and power transformer. A commercial broadcast "Reinartz" coil has been wired for "plug-in" use but home wound coils can be used to cover all bands.

ALTERNATIVE VALVES

We are inclined to say that zero bias could be employed quite safely with any of the twin triodes you are likely to use. They certainly won't have to draw too much current but there is just a chance that the lower gain types will distort slightly on strong signals.

If you want to experiment, try wiring a 500-ohm resistor between the cathode pin and chassis. Connect a 25 mfd condenser in parallel with it, the red end going to cathode.

Installing or removing the resistor will affect slightly the HT voltage applied to the detector and will call for some readjustment of the reaction condenser. Don't trick yourself therefore by listening to one signal without at the same time readjusting the reaction control.

What now is involved in the construction of the set?

Firstly, due to limited space here, we must presume that you have read the introductory articles to either of the two beginner series mentioned at the beginning of the article and are able to distinguish between, say, a resistor and a capacitor, and that you have had just a little experience in making a soldered joint. For the rest, it's merely a matter of completing the mechanical work and tackling the wiring.

CHASSIS LAYOUT

We sized the chassis to give sufficient room without having too much waste space. Whether the chassis manufacturers place a ready-made chassis on the market will depend largely on the demand. With simple sets such as this, many readers choose to bend up the chassis themselves to suit their own requirements.

We made the original chassis out of 16-gauge aluminium and the front panel of 18 gauge. Aluminium lighter than 16 gauge for the chassis may well call for end plates to provide rigidity for short-wave reception. A lighter gauge in steel would be OK, though.

The rear view of the set shows where the major components go on the chassis top. Note the gang mounting. Place the mounting brackets on that end of the frame which will allow the plates to open outwards and downwards. This places the gang spindle on the vertical centre-line of the front panel with a good balance of the dial with the knobs.

Make a cut-out for the dial cord drive to pass through to the knob spindle and extend the opening to a little past the lower edge of the dial escutcheon. The escutcheon will now sit almost on the chassis and the dial centre will align with the gang spindle.

The dial cord is passed twice over the knob spindle so that it will be in contact for about 1½ turns and wound around the dial drum drive secured to the gang spindle. The necessary tension is provided by the attached coil spring.

The lay of the socket mounting holes can be seen from the rear photograph. Viewing the chassis from underneath we arranged the sockets in the following manner:

COLOR CHART

VALUE	BODY	END	DOT
1 megohm	brown	black	green
.05 megohm	green	black	orange
.01 megohm	brown	black	orange
500 ohms	green	black	brown

The 7-pin socket for the 6X4 has the gap between pins 1 and 7 toward the front panel, the 9-pin socket for the 12AT7, with the gap toward the 100 pf regeneration control, the two fat pins of the 6-pin socket away from the phone jack.

Actually, the 6-pin socket could be mounted in any position as we merely used for the connections whichever pins were suitable and wired the coil connections on the plug-in formers to suit.

For connections to the chassis, place solder lugs under the following bolts . . . diagonally opposite bolts holding the power transformer, the two bolts holding the gang front bracket, under the 12AT7 socket bolt nearer the tuning gang.

Place a 3-tag mounting strip under one of the bolts holding the gang rear bracket and a 5-tag strip under the coil socket bolt away from the phone jack.

We suggest that you commence the wiring by cutting the transformer leads to length and attaching them to the appropriate pins of the 6X4 socket. Of course, the HT secondary centre-tap connects to chassis.

Now connect up the complete heater circuit, solder pin 3 of the 9-pin socket to the centre spigot and connect the centre spigot to the adjacent solder lug.

Lay in the simple wiring runs and begin to fit the components into place. Use spaghetti covering over the pigtail leads of components where there is a risk of them shorting to something.

See that you connect the two electrolytic capacitors in the correct polarity, as indicated on the circuit.

The 100 pf regeneration capacitor has the moving plates grounded through a lead to the nearest solder lug rather than relying upon the connection through the chassis when it is tightened in its mounting hole.

FEEDBACK CONTROL

Before securing the capacitor in place unscrew one of the outer bolts holding the fixed plates and fit a solder lug for the connection to the coil socket. This keeps the lead short.

The inside lug of the 5-tag mounting strip carries the plate end of the .01 meg plate resistor and is connected to pin 6 of the 12AT7 socket.

We have used a pie-wound RF choke at the detector anode. You could fit in the larger single-pie choke if you have one on hand.

We suggest that you use 3-core power flex for connection to the power mains, taking the green colored lead for connection to the chassis. The other end connects to

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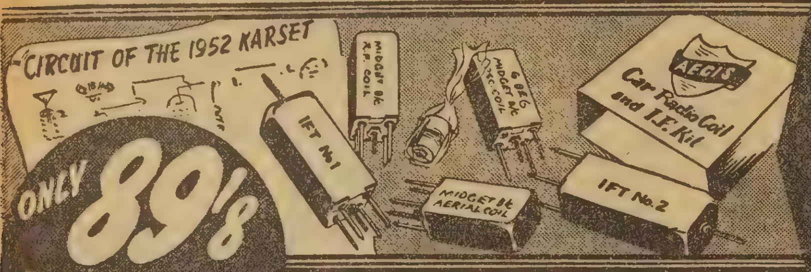
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FOR THE R & H 4 valve KARSET FEATURED IN APRIL

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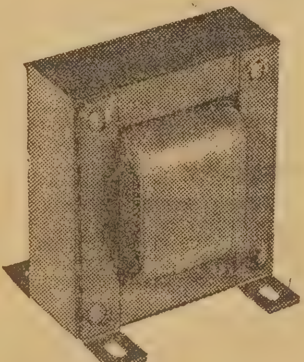

RATINGS

Type VT198	Prim. 6v. Sec 250v. at 55mA
Type VT201	Prim. 12v. Sec. 250v. at 55mA

This transformer is the smallest vibrator transformer available, the dimensions being height—2⅝in, width—2¼in, thickness—2¼in

FERGUSON TRANSFORMERS PTY. LTD.

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Available from all Leading Wholesale and Retail Distributors the "EARTH" pin of the 3-pin power plug.

The set has been designed and wired on the assumption that plug-n coils will be used. Thus it is simply a matter of plugging in the appropriate coil to tune as desired on the broadcast or the short-wave bands.

If you are not interested in short waves, then a standard commercial Reinartz coil could be wired permanently into position, forgetting all about the plug and socket idea.

If you do use plug-in coils you may as well follow our lead in laying out the wiring, although variations are permissible.

We used a standard six-pin valve socket, connecting pin 1 to the reaction condenser, pin 2 to plate, pin 3 to earth, pins 4 or 5 to aerial and pin 6 to grid.

For the broadcast band you can use either a miniature commercial Reinartz coil mounted on an old six-pin valve base, or you can wind up a coil of your own on a commercial 1¼-inch diameter former.

CHOOSE YOUR COILS

The commercial Reinartz coil has to be wired to the old valve base to correspond with the suggested wiring to the socket. Thus the lug coded as "reaction condenser" must be wired to pin 1, the lug coded as "detector plate" to pin 2, "earth" to pin 3 and "grid" to pin 6.

Most commercial Reinartz coils have two aerial connections marked either A1 and A2 or long aerial and short aerial. These lugs can be wired through to pins 4 and 5.

Underneath the chassis you must ultimately wire the aerial connection to pin 4 or pin 5, whichever one appears to give the better balance of volume against selectivity.

Don't forget that when wiring to the coil plug you have to number the pins looking on the ends of the pins themselves. If you don't you are likely to get all the connections the wrong way around.

If in doubt, trace each coil lead through to its appropriate point in the set wiring, making sure that each lug goes to the proper place, just as if the socket were not there.

Winding your own coils is a slightly tedious but completely practical proposition. What is more important, it is excellent experience.

For the broadcast coil you will need a commercial six-pin former with a diameter of 1¼ inches.

MAKE YOUR OWN

Using a fine drill or a nail, drill a small hole low down and alongside pin 3 on the former. Drill another hole alongside pin 4 but just over an eighth-inch higher up on the former.

Thread a length of about 32 B & S gauge enamelled wire through the lower hole, through the hollow pin 3, clean the end with fine emery paper and bend it over ready to solder inside pin 3.

Now wind on 15 turns, close wound, thread the end through the former and solder into pin 4. This is the aerial connection.

Now drill another hole above 3 and just clear of the winding you have already put on. Clean the end of some 24 B & S gauge enamel wire, pass it down through the hole, through into pin 3 and solder both wires into position. This is your earth connection.

Wind on 110 turns in the same direction as you wound the first

(Continued on Page 96)

WORLD'S NEWS—Every Monday—6d

BUILD A PORTABLE TAPE RECORDER

with a Lightweight Deck from ELMEC

Note these features. • Weight 8¼lb complete. • Dual speed 7½ and 3¾ inches/sec. • High speed rewind with tape. Automatically lifting off heads. • Motors included, no external drive necessary. • Obtainable with or without heads. • With heads the deck is complete and ready to connect to an amplifier.

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Other Tape Recorder Parts Available

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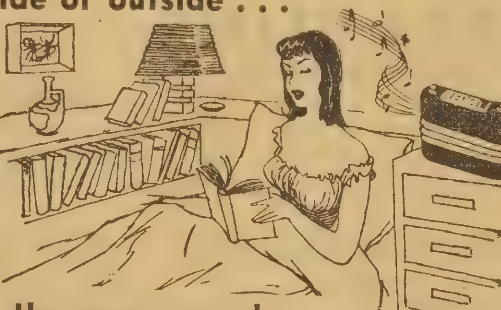

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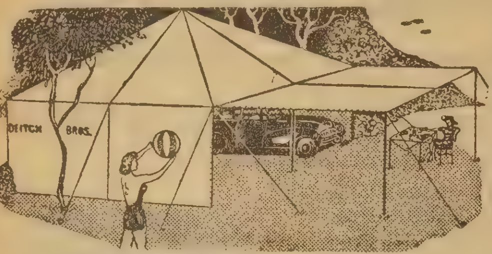

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SPECIAL ! GREEN PROOFED TOP LIGHT WALLS

10 x 10 **£24/12/6** 12 x 12 **£27/15/-**

Or with 12 and 14oz. BRITISH PROOFED DUCK. Tailored Top with 8oz. Duck Walls. Complete with Ropes, Poles, etc. 6ft. Walls.

	12oz.	14oz.
10 x 10	£29/1/9	£32/5/3
12 x 12	£34/2/6	£38/9/9
15 x 15	£44/4/3	£50/13/6

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12oz. BRITISH PROOFED DUCK TARPAULINS. All Brand New.

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10 x 12 ..	£8	1	3	12 x 15 ..	£12	5	0
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LEAN-TO gives your verandah 7ft. x 8ft. for your car and one spacious room for living. **Price £22/2/0**

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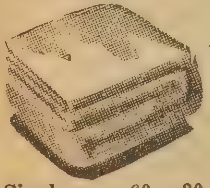

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Double Bed, 70 x 90, Grey .. .. .. 42/6 ea.
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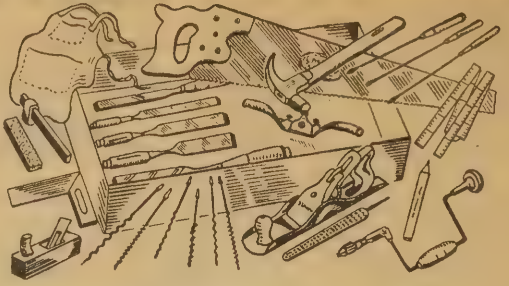

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Ideal for Carpenters, Handymen.

1 Rabone 3ft. Folding Rule.
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1 Set of 5 English Chisels, ¼, ⅜, ½, ¾, 1.
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3 Hardwood Bits, ¼, ½, 1.
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1 24oz. Claw Hammer.
1 10in. Rasp.
3 Assorted Nail Bits.
1 Marking Gauge.
3 Turner Screw Drivers, 4in., 6in. and 8in.
1 English Steel Square.
1 Pencil.
1 Sharpening Stone, and
1 Carpenters' Duck Apron, FREE.

The Lot - - - - £14/7/6

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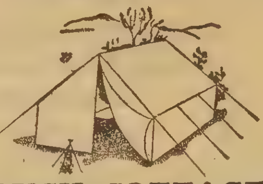

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with 12oz. and 14oz. British Proofed Duck. Tailored Roof. No Fly necessary.

	12oz.			14oz.		
6 x 8	£9	16	0	£11	10	3
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Super Quality 36in. unbleached Calico 50lb. Flour Bags. Ideal for pillow slips, tea towels, laundry bags, meat bags, or for sending food parcels.

15/- Per Dozen

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Super quality unbleached calico, 36in. wide. 10yd. lengths. **32/6**

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Brand New Extra Strong 22oz. Jute Canvas Top.
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Please add 2/6 Cartage to Rail.
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Wide Belt Loops. Size: 30 to 40. **33/6 pr.**
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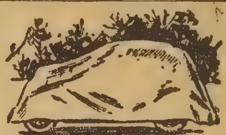

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12 x 15 £3/17/6 — Save £1.
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SPECIAL REDUCED PRICES.

8 x 25 French £12/10/-
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WELL PACKED. POST (insured) 7/6.

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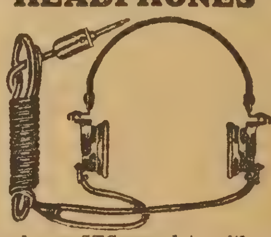

Brand new STC complete with cord and plug.
2000 ohms impedance. Suitable for Crystal Sets.
OUR PRICE **35/-**
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UNBLEACHED SHEETING

54in. SUPER QUALITY

4/9 yd.

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Post 5/8, Interstate 9/-.

A SURVEY OF RADAR TECHNIQUES

PART 1 — HOW RADAR OPERATES

From being a secret and vital defence measure in Britain during 1940, radar has emerged as a standard navigational aid, a widely-used research tool and the basis of all automatic defence and attack. This series of five articles will explain some of the vital underlying principles.

HISTORICALLY, the use of the basic radar principle, ie, the detection of surrounding objects or obstacles by echoes reflected from them, is not new.

In nature, the radar system has been used for as long as wild geese and other migratory birds have navigated through darkness and overcast by "honking" or making other sounds whose echoes warn of approaching obstacles. See Fig. 1.

Bats, too, are credited with masterful blind navigation by uttering a series of short, supersonic squeaks and interpreting the echoes from these in terms of range and bearing information.

OLD SAILORS!

Man has utilised the same scheme to some extent in navigating rivers and harbors. Old skippers of ferries, river boats and coastwise steamers have been known to develop a remarkable faculty for determining their bearings, despite fog or darkness, by listening to distinctive echoes of the boat's whistle bouncing off shore lines or passing craft.

Many such men of long experience and practised ear claim to be able to differentiate between rocky or wooded coastlines, as well as glean a good estimate of the size and type of a passing vessel, by the nature of the echo.

The first use of electronic radar is attributed to Sir Watson-Watt in England, in 1935, although the technique of detecting the echoes of short pulses of radio frequency and energy had been used much earlier (1925) by Breit and Tube to measure the height of the ionosphere.

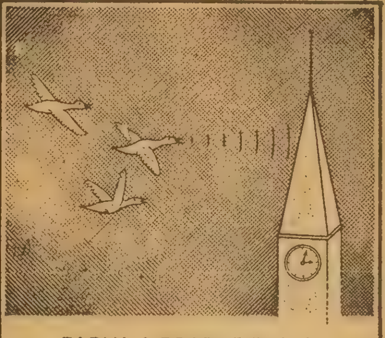
This work suggested the possibility of obtaining echoes from aircraft and other objects smaller than the ionosphere to a score of workers in several major countries. As a result, successful radar systems were developed almost simultaneously during the late thirties in France, England, Germany and America.

BASIC PRINCIPLES

The fundamental elements of a radar system are shown in Fig. 2. Very short pulses of radio frequency energy, which recur at regular intervals, are generated by the transmitter. These intense "bursts," which may be only one millionth of a second in duration, are radiated by the antenna in a narrow beam.

These waves propagate through space with the speed of light and upon striking a reflecting object, are returned to the receiver as an echo. The output of this receiver is connected to the vertical plates of an oscilloscope.

The horizontal plates of this 'scope are driven by a linear, saw-tooth sweep generator, which is synchronised with the transmitter pulses in such a manner that the sweep starts across the face of the 'scope at the time of each transmitter pulse. Received echoes then form small vertical "pips" on the base line, which represent reflecting objects at distances indicated by their positions on the time base. See Fig. 3.



EARLY AIRBORNE RADAR

FIG.1

Since radio waves travel in space at a constant velocity, the range of a target indicated on the display oscilloscope may be accurately determined by measuring the time elapsed between the transmission of a pulse and the reception of an echo.

This is easily done, since the 'scope sweep is linear with time and so can be calibrated directly in range. The range of a target in yards is thus related to the echo time by:

(1) $$\text{Range (yds.)} = \frac{327.5\,t}{2}$$

Where: t is the echo delay time in microseconds (μ sec.)

327.5 is the free-space velocity of radio waves (yds./sec.)

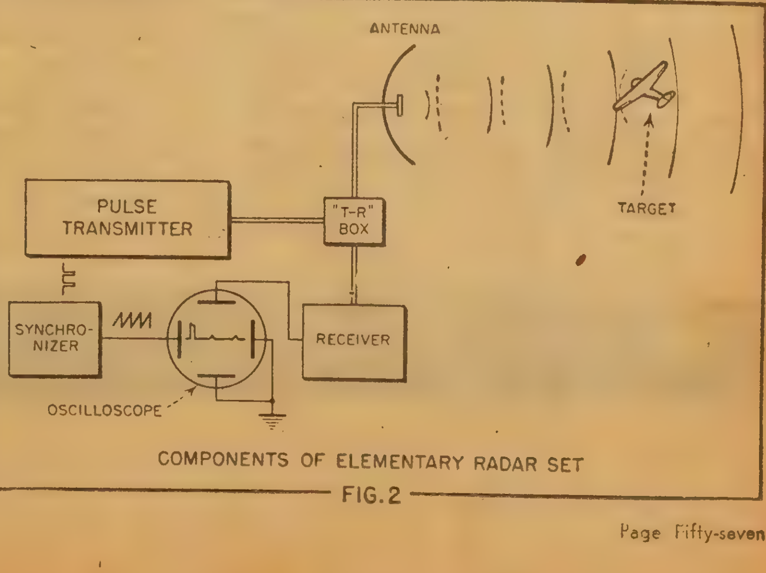
Note that the distance travelled by the waves (velocity times time) is divided by the factor 2 for the actual radar range, since the waves must travel this distance twice, going to the target and returning.

To facilitate measuring range, the time base is frequently provided with range markers, as illustrated in Fig. 3. These range calibration points are formed by feeding a pulse signal into the vertical deflection plates.

The repetition rate of these pulses is chosen to correspond to time intervals, which represent convenient increments of range, such as 5000 or 10,000 yards. Markers of this type ensure accurate ranging, even when the time base departs from linearity.

The angular bearing, or azimuth, of the target, is determined by the directional position of the antenna. Information on the elevation of aircraft is obtained in the same manner. The range indicated in this case is called the "slant range." The ground range and altitude are then calculated by simple trigonometry, as shown in Fig. 4.

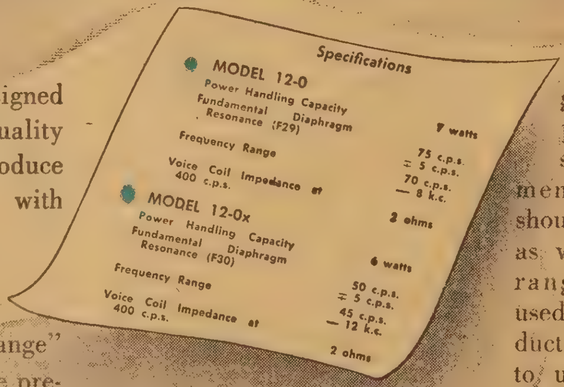
The accuracy of these measurements is limited by the beam width of the antenna pattern. In practice, beam widths of less than one degree are achieved by using large, highly directional antennas, and very short operating wavelengths.



COMPONENTS OF ELEMENTARY RADAR SET

FIG. 2

Experts have hailed Rola Models 12-0 and 12-0x as the world's finest loudspeakers in their class and vastly superior to many more expensive types.



Specifications

● **MODEL 12-0**	
Power Handling Capacity	7 watts
Fundamental Diaphragm Resonance (F29)	75 c.p.s. ± 5 c.p.s.
Frequency Range	70 c.p.s. — 8 k.c.
Voice Coil Impedance at 400 c.p.s.	2 ohms
● **MODEL 12-0x**	
Power Handling Capacity	6 watts
Fundamental Diaphragm Resonance (F30)	50 c.p.s. ± 5 c.p.s.
Frequency Range	45 c.p.s. — 12 k.c.
Voice Coil Impedance at 400 c.p.s.	2 ohms

Model 12-0 was designed for use in high quality radiograms to reproduce 78 r.p.m. records with fidelity and realism. The later Model 12-0x catered for "wide range" enthusiasts who were prepared to use the most expensive types of pick-ups and amplifiers.

Model 12-0x is too fine a loudspeaker to use with ordinary equipment, but the advent of L.P. discs made desirable a loudspeaker possessing a top response between that of 12-0 and 12-0x. Rola met this with a 12-0 fitted with a special F29 diaphragm giving a very even response to 8 k.c. This new 12-0 is the practical answer to the problem of getting maximum performance from standard equipment although it should be stressed that, as with any extended range loudspeaker used for record reproduction, it is essential to use a pick-up the response of which is free from peaks and undesirable resonances. The improved Model 12-0 can be identified by its diaphragm which has five concentrically spaced corrugations and a glossy finish to its rim.

Model 12-0x is *still* Australia's finest extended range loudspeaker, but the new 12-0, with its F29 diaphragm, does an equally fine job in the field for which it was designed.

ROLA CO. (AUST.) PTY. LTD.

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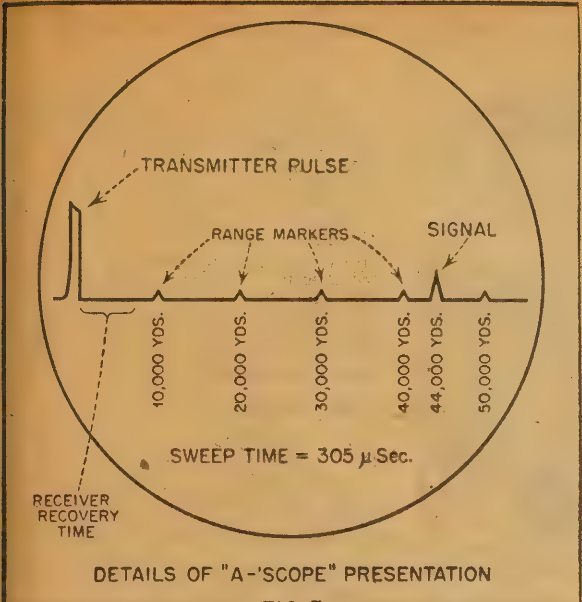


DETAILS OF "A-'SCOPE" PRESENTATION

FIG. 3

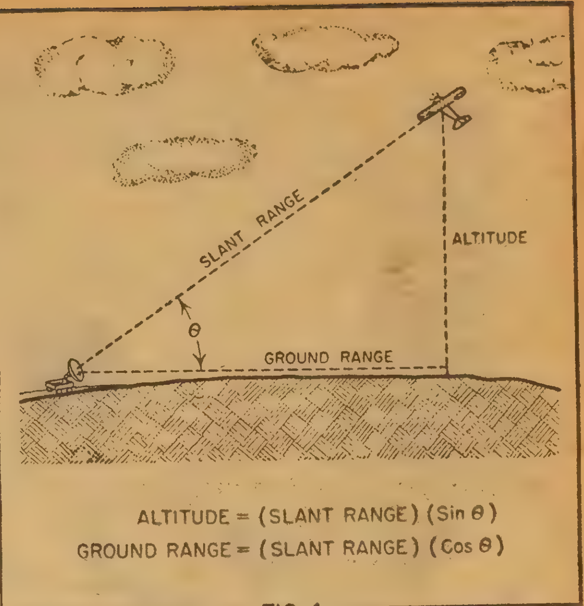

SLANT RANGE
ALTITUDE
θ
GROUND RANGE
ALTITUDE = (SLANT RANGE) (Sin θ)
GROUND RANGE = (SLANT RANGE) (Cos θ)

FIG. 4

Although some radar sets have used separate antennas for the functions of transmitting and receiving, the arrangement illustrated in Fig. 2 is much more convenient. Both transmitting and receiving is done with the same antenna by using a system of automatic switching known as "duplexing."

By this method, the receiver is effectively disconnected from the common transmission line during the "on" time of the transmitter and so is protected from overload and burnout damage by the high power transmitter pulses.

Between transmitter pulses, the receiver is automatically connected to the line and the transmitting tune is isolated to prevent it absorbing some of the received signal.

THE "T-R" SWITCH

Duplexing is usually accomplished by using a gas-filled switching device known as a "transmit-receive tube" or, more simply, a "TR box." The functioning of duplexing devices will be more fully discussed in a subsequent issue.

The method of displaying information illustrated in Fig. 3, known as an "A-scope" presentation, is only the simplest of many possible types. Although used universally on early radar equipments, it was soon replaced or supplemented by more advanced kinds.

One of the most useful of these is the Plan Position Indicator, or "PPI," depicted in Fig. 5. This type displays a map of the terrain surrounding the radar set in polar co-ordinates, with the set at the centre of the oscilloscope face.

To do this, a radial sweep originates at the centre of the tube and is rotated angularly about this point in synchronism with the position of the antenna, which is continuously scanned in azimuth. Received signals are used to intensity modulate the electron beam so that a bright spot is "painted" at the range and azimuthal position of each target.

The use of long persistence phosphors enable the 'scope to retain these images until renewed by another antenna scan.

The radial sweep is produced by a rotating electromagnetic deflection system which is synchronised with the antenna angle by an electrical or mechanical linkage. Presentations of the PPI type are especially useful for navigational radar.

The range of a radar equipment is determined by many design factors. The minimum range at which a target may be detected is limited by the duration of the transmitted pulse and the recovery time of the duplexing system. If the transmitted pulse is too long, echoes from objects at close range will be returned while the transmitter is still operating and the receiver is blocked by the TR system.

Since the TR tube requires a finite time to recover after each pulse is sent, the receiver also remains inoperative for a short time after the completion of the pulse. The result is a "blind spot" in the immediate vicinity of the radar set which is usually of little consequence, since long range operation is the most important in most applications.

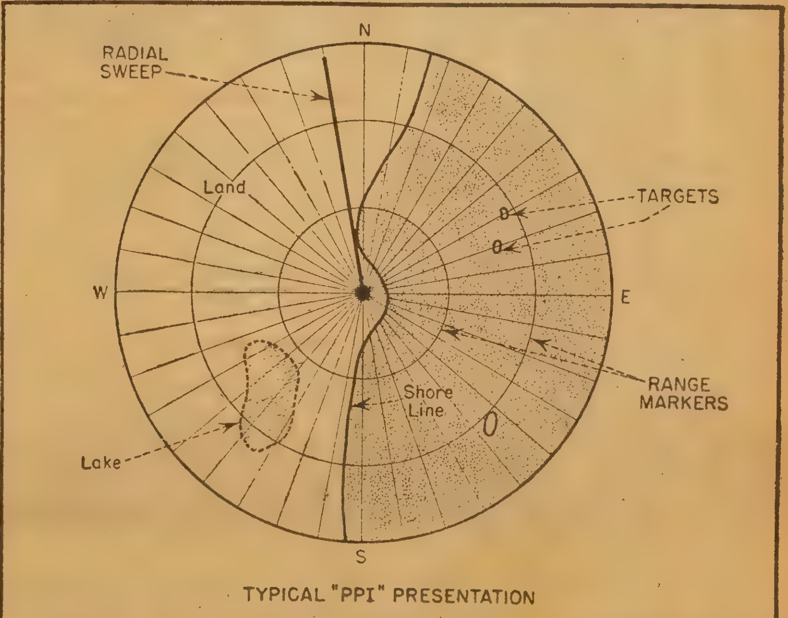
The maximum range obtainable from a radar set of a given design depends upon such factors as transmitter power, size of the target, gain of the antenna, sensitivity of the receiver, operating wavelength, &c. These factors have been related by what is commonly called the "radar equation":

$$R_{max} = \sqrt[4]{\frac{P \sigma A^2 f^2}{4 \pi S_m \lambda^2}} \qquad (2)$$

Where:

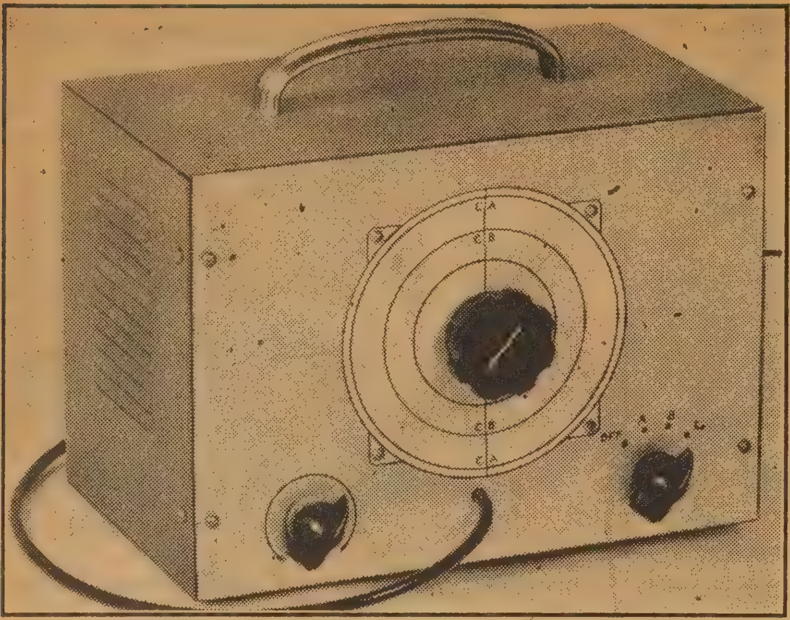
R_{max} is the maximum range in miles
P is the peak transmitter power (watts)
σ is the reflecting area of the target
A is the antenna aperture (sq. ft.)
f is an antenna illumination factor (between .5 and 1.0)
S_m is the minimum signal the receiver will detect (watts)
λ is the operating wavelength (ft.)

(Continued on Page 76)



TYPICAL "PPI" PRESENTATION

FIG. 5



A front view of the completed oscillator housed in the Radio and Hobbies standard instrument case. The attenuator knob is on the left and the combined wave change and filament switch on the right. The dial, made from thick card and bolted to the front panel was still to be calibrated when this picture was taken.

A SIMPLE 3-BAND OSCILLATOR

The success of the extremely simple Switched Tuned Oscillator, described in the March issue of Radio and Hobbies, has prompted the question of its possible development into a continuously tuned oscillator while retaining the essential simplicity of the original circuit.

by Philip Watson

THE switched tuned oscillator was designed with two thoughts in mind; firstly to produce an inexpensive instrument which the home constructor could use to align his home built receivers and, secondly, to build it completely from parts normally available in a radio store.

When we commence to think in terms of the more conventional continuously tuned oscillator the position is somewhat different.

Such an oscillator is more likely to be required by those interested in service work rather than the straight out home builder, while the need for special coils, not normally available over the counter, means that the constructor must be prepared to indulge in a little "cut and try" in the process of adapting available coils to suit.

RETAIN SIMPLE CIRCUIT

While recognising these points, we wanted to retain the basic simplicity of the original design with its advantages of moderate HT voltage, low current drain, and simple one valve circuit. Any major deviation from the above would obviously complicate the design to the point where an entirely new approach would be justified.

Reference to the circuit will show that the new design is simply a set of coils, a coil switch, and a tuning gang added to the original simple one valve oscillator.

Originally we had envisaged a two band oscillator; one band covering the IF channels from 175 Kc to at least 470 Kc, and the other covering the broadcast band.

However, subsequent experiments showed that it is possible, with a little care, to obtain satisfactory operation on the short-wave bands as well, so we have planned the switching to allow for at least one additional coil, though the use of a standard five position switch means that two more could be used, making four bands in all.

In most cases it is likely that one band, covering the popular short-wave band, will be all tha is required.

The need to accommodate a tuning gang, a band selector switch, an three coils, meant that the origina case was no longer suitable and i was decided to build the new uni on a chassis and panel which coul be housed in a standard Radio an Hobbies instrument case.

This is actually somewhat large than necessary and there is no doub that, by careful planning, it woul be possible to use a smaller cas On the other hand, the case chose is standard type which should b more readily available than a specia besides matching any other instruments housed in the same style case

ODD BOXES

At the moment we do not anticipate preparing a blueprint for th chassis, since this would be quit simple for most home constructors t make for themselves, simply addin it to the ready made box and pane It is also likely that many constructors will prefer to use an od metal box which they already possess, and thus will need to prepar their own layout to suit.

The gang used is a standard "H' type, although almost any other typ having similar maximum capacitanc would be suitable. For those wh may wish to save space and buil their own box, one of the midge types would be quite suitable bu where a standard box is used, ther is no reason why something from the "junk box", providing it is mechanically sound, should not be used

The wave change switch is a two bank, two-pole, five-position type One section switches the grid windings, the second the plate windings and the third the filament circuit This enables the fourth position o the switch to be used as an "OFF position.

COILS

The most convenient wiring is provided by using one of the deck nearest the front panel for the filament circuit and the two rear deck for the coil connections. One section of the switch is not used.

For the broadcast coil we used standard "Reinartz" type, using th grid and plate windings, but ignorin the primary winding. This is mounted above the chassis in the usua way, the pins being only a few inches from the switch contacts. N doctoring of this coil should b necessary and the connections give by the makers need only be followe in order to secure correct phasing

Before commencing the other coil it is necessary to provide some mean of checking their coverage and roadcast receiver is about the best r this. It should, ideally, have an curately calibrated dial and an IF iannel which is correctly aligned id the frequency of which is known. a short-wave band is planned, the t will have to cover this portion the spectrum also.

For the IF coil we first obtained discarded IF winding from the junk ox and determined which of the vo windings was still intact. In ır case it happened to be the upper ıe, so we cut through the coil ırmer with a hacksaw just above ıe lower winding. The latter was ıt to one side but not discarded.

In order to mount the good winding we obtained about half an inch dowel having a diameter which as a neat fit inside the coil former. his was drilled longitudinally to ovide a push fit for a 1/8in bolt. ith the bolt in place the dowel as given a coat of cellulose cement ıd forced into the coil former with e bolt head on the inside. This ft a length of bolt protruding and hich was subsequently used to cure the former to the chassis.

DDITIONAL WINDINGS

Next step was to provide a feedack winding alongside the existing id winding. For this we used wire ken from the discarded bobbin and ramble wound 130 turns hard gainst the grid winding. A liberal ose of cellulose cement was applied the winding to hold it in place nd, when this was dry, the coil was onnected temporarily into the circuit nd tested.

Once the correct phasing for the edback winding was found the arangement worked quite well, oscilıting and squegging over the whole and. However, the coverage was ot quite suitable, it being only just ossible to reach 175 Kc with the ang fully in mesh and the iron core rewed fully in, while at the high equency end the signals reached to ıe commencement of the broadcast and.

Since this indicated that the inuctance of the grid winding was ıst short of what was required, we ook some more wire from the disarded bobbin and added 35 turns to ıe grid winding, scramble winding ıem against the coil on the side reıote from the feedback winding. Make sure to continue winding in ıe same direction.)

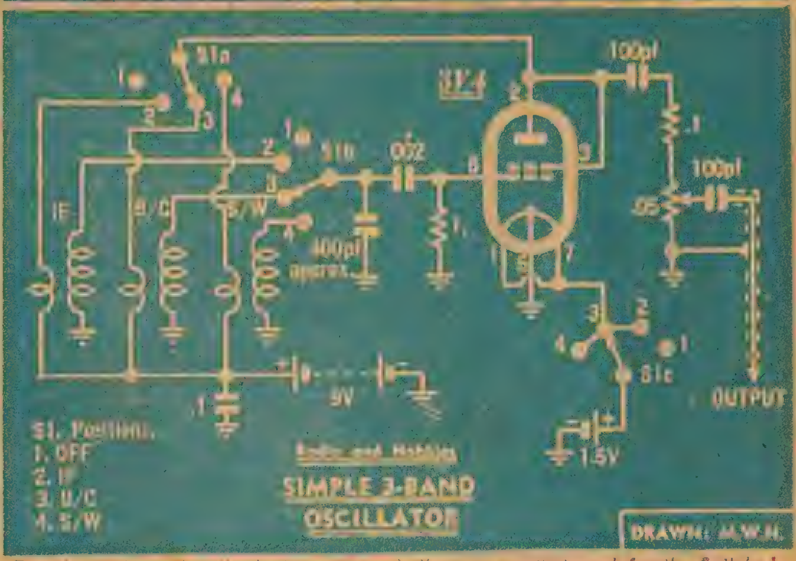
CHECKING COVERAGE

This proved quite adequate and rovided coverage from about 165 c to 500 Kc, thus adequately coverıg both the 175 Kc and 455 Kc IF hannels.

To check the frequency coverage f this band, using an ordinary reeiver, it is necessary to make use f harmonics, and a few comments n the method used may be helpful.

In order to identify a harmonic ositively it is necessary to check it t several points, otherwise serious rrors are possible unless the approxiıate frequency of the fundamental already known. For example: ssume that the oscillator is set near s lowest frequency at a spot which is anticipated will produce a 175 c signal. If a harmonic is found at 25 Kc it could be the third harmonic om 175, but it could also be the fourth harmonic of 131 Kc or the second harmonic of 262.5 Kc.

CIRCUIT OF THE OSCILLATOR



The circuit shows that the basic oscillator is the same as that used for the Switched Tuned Oscillator to which has been added a wave change switch, a tuning capacitor, and three coils. In spite of these additions it is still an extremely simple circuit.

However, if a harmonic is found at 525, 700 and 875 Kc it is obvious that the fundamental is 175, because these points are 175 Kc apart. By checking at as many points as possible any slight inaccuracies in the calibration of the receiver will be minimised.

PRECAUTIONS

At the high frequency end of the IF band it is possible to check both the fundamental, by feeding it into the IF channel, and the harmonics, which will still appear on the broadcast band.

When the coverage of the coil is considered adequate it may be permanently mounted on the chassis (see photograph), the leads cut to the exact length, protected with spaghetti and soldered into the circuit.

PARTS LIST

1	Radio and Hobbies Standard Instrument case 6½in x 9in x 5½in with front panel.
1	Chassis 8in x 5¼in x 2in.
1	3V4 valve.
1	Miniature 7 pin socket.
1	Reinartz coil.
1	IF transformer (see text).
1	Short-wave coil (see text).
1	2 bank, 2 pole, 5 position switch.
1	Single gang tuning capacitor (see text).
1	.1 mfd 200 volt paper capacitor.
1	.002 mfd mica capacitor.
2	100 pf mica capacitors.
1	1 megohm ½ watt resistor.
1	.1 megohm ½ watt resistor.
1	.05 megohm potentiometer.
2	4.5 volt batteries Type 703 or similar.
1	1.5 volt cell type 950 or similar.
1	Yd PT1M coaxial cable.
1	Medium finger grip knob.
2	Small pointer knobs.
1	⅜in to ¼in reduction shaft.
2	Alligator clips.
	Aluminium for battery brackets, nuts and bolts, hook-up wire etc.

When checking the coverage of the coil it is well to take into account the effect of the metal case when the chassis is finally mounted in it. This will reduce the inductance slightly so it is better to err on the side of too much rather than too little.

In order to ensure that the original calibration of the instrument is retained it is important that all wiring associated with the tuned circuits be perfectly rigid, so that whatever stray capacitances are present will remain constant. We wired all this portion of the unit with 18-gauge tinned copper wire, covered with spaghetti where necessary.

Obtaining satisfactory operation on the short-wave band is not quite so straight forward as on the two previous bands and the constructor must be prepared for a fair amount of experiment in order to secure satisfactory results. In this regard it must be remembered that the circuit is an extremely simple one and that the short-wave coverage should be regarded as an additional rather than an essential feature.

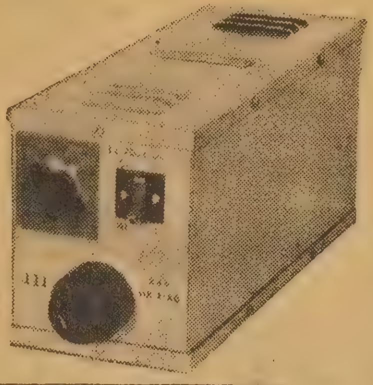
FUNDAMENTAL OR HARMONIC

There are two approaches to the problem. One is to provide a coil which tunes directly over the required band and the other is to use a coil covering a lower frequency band and to use the harmonics from this.

For the first approach we selected a discarded short-wave RF coil (brand unknown) and, using the grid winding in the normal way, connected the primary winding as a feedback winding. This functioned extremely well, covering from approximately 7 mc to 17 mc with consistent squegging over the whole band.

Since we could not be sure that

240 VOLT AC 50 CYCLE INVERTERS



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0-20mA DC 2½ inch Square Flush English Hobut. Brand new	25/-
0-10mA, DC 2 inch Round Flush	17/6
0-.5 amp, RF Thermocouple, New	12/6
0-3 Amp RF,	12/6
0-4 amp RF Square	12/6
0-30 mA 3 inch Round	25/-
0-20 Volt 2 inch Square	20/-
0-40 Volt 2 inch Square	20/-
0-20 Volt, 0-2000 Volt Round	20/-

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Scale Size — 4in.
Dia. Brand New

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readers would be able to purchase an exactly similar coil, we set about winding a similar one, just to see how critical it was. It soon became apparent that the details were extremely critical and that the original coil had to be duplicated very accurately in order to obtain satisfactory results.

Deviations from the original either caused insufficient coverage, failure to squegg over all or part of the band, or a squegging frequency which became progressively higher toward one end of the band until it passed beyond audibility.

For this reason we are supplying as much data as possible on the original coil with the suggestion that you may care to buy one which appears to have the same specifications or to wind one. In either case you may find it necessary to prune the original for final best results.

COIL DATA

The original coil was wound on a ¾in diameter former and fitted with an iron core. The grid winding consisted of seven turns of 22 gauge B & S enamelled wire space wound over 3-8th inch, and the primary winding was five turns of approximately 30 gauge silk-covered wire interwound with the grid winding. Both windings are in the same direction and the end of the grid winding farthest from the feedback winding should be used for the grid connection with opposite end connecting to earth. The end of the feedback winding nearest the earthed end of the grid winding connects to plate and the other end to HT.

For a coil to work at a lower frequency and to cover the normal short-wave band by means of harmonics we wound one to the following specifications: Coil former ¾in; grid winding, 14 turns of 24 B & S enamelled wire close wound; feedback winding, 14 turns of 30 gauge B & S enamelled wire wound over one end of the grid winding. This end of the grid winding connects to earth and the same end of the feedback winding to plate. Both windings in the same direction.

This coil covered from approximately 3 Mc to 6 Mc, which was rather less coverage than we had hoped for, though it would be possible to improve this by space-winding the grid coil. Nevertheless, when set at 3 Mc it provided signals at 6, 9, 12, 15 and 18 Mc, and these would be extremely useful in aligning a short-wave set.

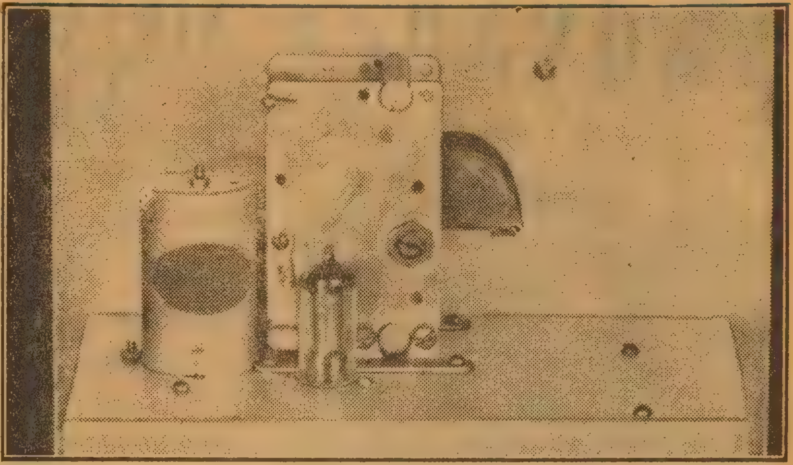
EXTRA BATTERY

If it is found that the strength of these harmonics is too low in some cases they can be strengthened quite appreciably by raising the HT voltage to 13.5 by means of an extra battery. In the original model this could be accommodated above the chassis.

The dial is composed of a medium-size finger-grip knob, a cursor of celluloid or perspex, and a scale drawn on stiff card and bolted to the front panel. Finger-grip knobs to fit the standard 3-8in gang shaft are not normally available, except to special order, so we fitted a 3-8in to ¼in reduction shaft to accommodate the ¼in hole in the knob.

For the cursor we used a piece of heavy sheet film salvaged from the photographic department and cleaned of emulsion by soaking in very hot water. Better material would be the heavier celluloid used for motor-car side curtains or, as previously suggested, a scrap of perspex if it is available.

REAR AND UNDERNEATH VIEWS



This rear shot shows the general arrangement of the major components above the chassis. The coil can houses the Reinartz coil which covers the broadcast band and the 3V4 valve can be seen mounted directly behind the gang.

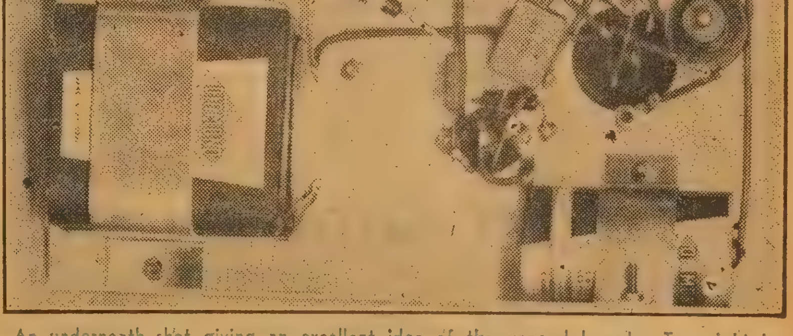
Fitting the cursor really calls for a pair of holes to be drilled and tapped in the back of the knob, but if celluloid is used it appears to be quite satisfactory to fasten it with cellulose cement. This arrangement will be more suitable for those readers who have limited workshop facilities.

As can be seen from the photograph the dial is marked out in four bands, and where only one short-wave band is provided it is a good idea to cover this with both frequency and wavelength markings. This feature will be found very useful, since both types of calibration are frequently encountered and tiresome conversions from one to the other are thus avoided.

Finally, there is the all-important matter of calibrating the finished instrument. Before this is undertaken make quite sure that everything, both physically and electrically, is exactly as you want it. After all, there is not much point in spending several hours carefully calibrating the instrument if such calibrations are to be rendered valueless by subsequent modifications to the coils or layouts.

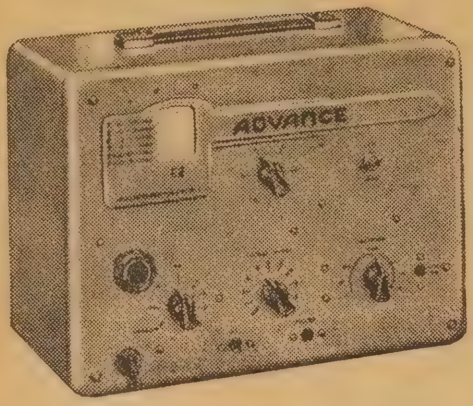
The broadcast band is relatively easy, since there are plenty of stations of known frequency to act as accurate markers, plus the fact that the signals from the oscillator can be tuned in directly. Nevertheless, an instrument such as the harmonic oscillator (Radio and Hobbies, February, 1951), which can be made to provide a signal every 100 Kc over the broadcast band, is a very valuable help for a job of this kind.

Without such a device much of the accuracy will depend on the accuracy of the receiver dial calibration, but in any case it should not be difficult to obtain a final calibration of the instrument at least equal to, and probably better than, that available in many commercial instruments



An underneath shot giving an excellent idea of the general layout. Top right is the wave change switch, below it the IF winding near the edge of the chassis, and alongside it can be seen the underside of the Reinartz coil. The short-wave coil is to the left of the switch and the attenuator at the top left of the chassis.

Advance SIGNAL GENERATORS



R.F. GENERATOR TYPE E2

Range:	100 Kc/s to 100 Mc/s in 6 ranges on fundamentals.
Accuracy:	Frequency calibration plus minus 1%
Modulation:	30% at 400 cycles
R.F. Output:	1 uV to 100mV, continuously variable through 75 ohm matched transmission line. A steady output of 1 volt is also provided through a separate socket. Using the termination pad, output impedances of 37 ohms, 10 ohms, or 10 ohms through a standard all-wave dummy aerial may be obtained.
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Output:	Sine wave—200 uV to 20 volts plus minus 1 db Square wave—400 uV to 40 volts
Rate of rise of square wave:	Less than 3 microseconds to reach 90% of peak value at 10 Kc/s
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here individual band calibration ould be prohibitively costly.

First allow the receiver to warm up r about 15 minutes and then check s calibration against the broadcast ations. If it has been correctly igned there should be virtually no ror at the two points at each end f the band where alignment is ormally checked (approximately 0 Kc and 1400 Kc) and for a con-derable distance to each side of ese points.

However, it is quite usual to find me error, probably about 5 Kc, at e centre of the band. Assuming at the calibration appears to be e best possible, you are ready to mmence calibrating the oscillator.

USING STATIONS

Commence by setting the receiver o the lowest frequency station which an be positively identified and then ouple the oscillator lightly to the eceiver, possibly by clipping the hot" lead from the oscillator on to he insulated aerial lead of the set.

Now set the oscillator until a signal from it is heard in the receiver, nd listen carefully for a beat note etween the two signals. This is not o easy to determine with the type f modulation used, but it can be eard if attention is given to the re-ative strength of the two signals.

The oscillator should be adjusted ntil the beat is as near as possible o zero. The oscillator dial should ow be marked lightly in pencil and he mark identified with the station requency.

Next set the receiver dial to the earest even 100 Kc marking and djust the oscillator to give the loudest signal in the speaker (an output meter is useful for this job), marking he oscillator scale as before. Repeat his procedure across the dial, and, where there is obvious error in the receiver calibration, the appropriate correction should be made when setting the receiver to the even 100 Kc marking.

When this job is completed, the scale should be fairly accurately calibrated at 100 Kc points and at intermediate points representing station frequencies. The next step is to fill in the gaps between these points at, say, every 10 Kc, which is the figure usually employed in commercial instruments.

ADDITIONAL CHECKS

Where it is obvious that the receiver calibrations are accurate, these points may be determined directly from them, but where errors are apparent, allowance will have to be made for them and as many check points as possible provided by other means. For example: It is quite feasible to set the oscillator quite accurately to a spot at the low frequency end of the broadcast by means of a station, then to use its second harmonic to provide an accurate marker in the centre of the band. With the receiver set to this point the oscillator may then be tuned to provide the corresponding fundamental frequency.

In practice, you will find that there are many such ways in which the scale markings can be checked, and you should eventually be able to fill in all the gaps with the assurance that they are quite accurate.

To calibrate the IF band, it will be necessary to work from harmonics, since a receiver to cover this band will not normally be available.

As mentioned earlier, it is necessary to check harmonics at several points on the broadcast band in order to be sure that the correct fundamental is being generated. Once again, much of the accuracy will depend on the accuracy of the receiver dial calibration and the number of stations which can be used as accurate markers, but no difficulty should be experienced in obtaining a number of accurate points on, and to each side of, the main IF channels.

It is desirable, if possible, to calibrate this band in 5 Kc steps, at least around these important points.

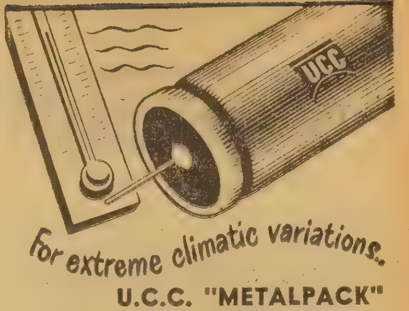
SHORT-WAVE CALIBRATION

The short-wave band is dealt with in much the same way as the broadcast band, except that there are not so many stations readily available to act as markers. However, good use can be made of the local high-powered short-wave transmitters, such as Radio Australia and the ABC short-wave outlets, to keep check on the accuracy of the receiver calibrations.

Other check points are the standard WWV signals, as mentioned in the March issue of Radio and Hobbies. For ordinary service work a scale calibrated to 1 Mc steps is usually adequate.

A very important point to watch when working on the short-wave band is the double spot which almost

(Continued on Page 96)



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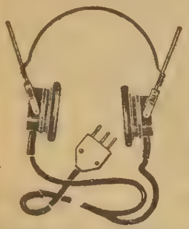


HEADPHONES

We have stocks of the following Headphones, both are brand new and boxed in perfect condition.

GERMAN HIGH IMPEDANCE PHONES (Illustrated)

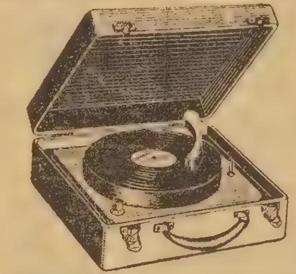
Impedance 4000 ohms; Adjustable for maximum output and clarity; light weight, each fitted with cord and plug. A very fine phone, ideal for crystal sets and for any other purpose. Worth £4/10/-.

OUR PRICE 39/6.
Weight 1½lb.

ENGLISH LOW IMPEDANCE PHONES

Robustly constructed and efficient in operation, fitted with cord and plug. Worth £2.

OUR PRICE 18/6.
Weight 1½lb.



ENGLISH 3 Speed Record Players

Well-known make in attractive leatherette covered case, each with turnover crystal head and permanent sapphire needle for standard and microgroove records. Automatic stop and start. The best value offered yet in this line. Worth 22 gns.

OUR PRICE 16 GNS.
Weight 12lb.

NOTICE

All parcels sent registered post unless otherwise stated. Postage or freight must be included with order.

SPECIALS ! SPECIALS !

(1) 0-5 M.A. Brand New English Meters, excellent quality and boxed, Square dial, 2 inch scale. Ideal for construction of voltmeters, ohm-meters, etc.
A bargain for 25/-

(2) 0-50 M.A. as above 22/6

(3) 0-20 Voltmeter. A square cased meter as above, also suitable for constructing multimeters and suitable for 12 volt lighting plants, battery chargers, etc. Brand new 19/6

(4) 0-40 Voltmeter similar to above. Brand new 19/6

(5) 0-1 M.A. meter, very nice movement. Brand new and boxed, 1000 ohms per volt, 2 inch scale, square dial, well worth £4.
Our price 32/6

(6) Moving Iron Meter, with 4½ inch round Bakelite case; you can make up whatever A.C. meter you wish with this movement by winding your own coil on the meter bobbin. Worth £2.
Our price 10/9

(7) Half Wave Dry Metal Rectifiers, 125 M.A. for voltages up to approx. 100 volts.
Sacrificed for 4/6 each

(8) Oak type Switch Wafers. 3 pole, 2 position .. .. **9d each**

(9) Gramophone Pick-up Rests. Various types available in Walnut and Ivory Plastic .. .. **9d each**

(10) Push Buttons suitable for Door Bells, Test Panels, Dial Lights on Radio, etc. Worth 2/6.
Our price 1/- each

(11) Phone Plugs standard type each with approx. 5ft rubber-covered flex .. .. **2/9 each**

(12) Phone Jacks to suit above, **2/9 ea.**

(13) **Black Indicator Knobs** for ¼-inch shaft, tapped for 5/32 Whit Grub Screws, ideal for instrument panels, etc., **3d each, 2/- dozen**

Job Line Wire Wound Resistors by well-known makers, IRC, Merlin, Kriesler, etc.

(14) 5500 ohms, 12 Watt 2/-

(15) 4000 ohms, 30 Watt 2/6

(16) 14000 ohms, 12 Watt 2/-

(17) 4500 ohms, 12 Watt 2/-

(18) 800 ohms, 12 Watt 2/-

(19) 800 ohms, 16 Watt 2/3

(20) 7000 ohms, 16 Watt 2/3

(21) 125 ohms, 10 Watt 1/-

(22) 100 ohms, 10 Watt 1/-

(23) 500 ohms, 10 Watt 1/-

(24) Double Ignition Switches, Heavy duty, with large nickel toggles. Two single pole switches in each unit .. .. **2/9 each unit**

(25) Heavy Duty 100 ohm Rheostats as used in aircraft, housed in Bakelite Case **2/3**

(26) Heavy Duty 250 ohm Rheostats, 25 Watt, Porcelain and Mica insulation. An excellent job **4/6**

(27) Nylex Bell Wire, Random Lengths, 1/.028, approx. 50yd Rolls, **4/- each**; approx. 100yd. Rolls, **6/6 each**

(28) Nylex Hook-up Wire, 10/.010 Random Lengths.
Approx. 50yd Rolls .. **8/6 each**
Approx. 100yd Rolls .. **14/6 each**

(29) Push Back Hook-up Wire, ideal for set wiring.
100yd Rolls, 30/- each

(30) Outdoor Aerial Wire, waterproof. 50ft., 3/6; 100ft., 5/-.

(31) **Micro Switches.** Many different types available. Single and Double Pole, etc. **All one price, 5/6 each**

(32) Yaxley 1 bank 3 pole 3 position switches. A few only available, **3/6 each.**

(33) Well-known make windscreen type car radio Aerials, 2 piece with suction cup and lead in. Worth £3/5/-. **Our price 35/-**

(34) Undercar Aerials, with lead in. Worth £4/10/-. **Our price £2/5/-**

(35) Porcelain Egg Insulators, **6d each**

(36) Ceramic Spacers, ¾in long, ¾in diam., 1-8in tapped hole.
2d each, 1/6 dozen

(37) Voltage Dividers, brand new and in good condition, 15,000 and 25,000 ohms. .. .. **2/9 each**

(38) .0001 Silver Mica Condensers.
6d each, 4/- dozen

(39) .0023, .0005 Mica Condensers.
6d each, 4/- dozen

(40) 2 gang .0001 Variable Condensers.
4/6 each

(41) Single Gang .00025 Variable Condensers .. .. **3/9 each**

(42) Army Type Morse Keys, **3/6 each**

(43) 7in x 7in Square Dial Escutcheons .. .. **2/6 each**
6½ x 5 Rectangular Dial, **2/6 each**

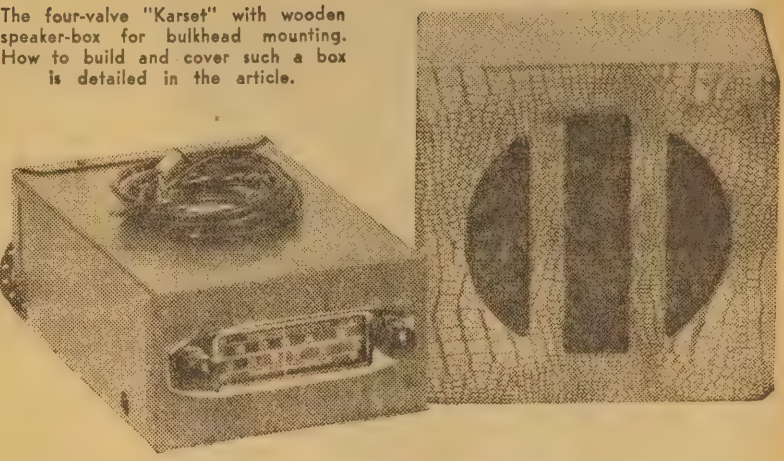
Note: Sizes are overall measurements and corners are rounded.

MOTOR SPARES LTD.

547 ELIZABETH ST.
Melbourne

BRANCHES THROUGHOUT VICTORIA AND RIVERINA

INSTALLING YOUR NEW "KARSET"



The four-valve "Karset" with wooden speaker-box for bulkhead mounting. How to build and cover such a box is detailed in the article.

The success or failure of a car radio depends on a great deal more than a suitable circuit to begin with. Its ultimate performance is just as much dependent on how it is constructed in the first place and how well it is installed in the car.

MOST radio receivers have a rather easy life, being housed in a decorative cabinet and treated with a ood deal of respect. Even the domestic mantel set or the baby portble is never knocked about delibertely.

A car radio, on the other hand, must spend its life bolted to the bodywork of a car and must inevitably take large share of the consequent umping and vibration. It must be uilt and installed with this thought oremost in mind.

The care should begin in the initial ssembly stage by placing a lockwasher under every individual nut nd tightening them firmly. Many ommercial manufacturers go a step urther and put a blob of lacquer n the thread as a further precauion against them ever working oose.

The wiring, too, should be carried ut carefully, making certain of each ndividual soldered joint. Use the mallest possible components, not nly because they make the wiring asier, but because they are less likely o be jolted out of position by subequent vibration.

Finally, after the testing has been ompleted and the set carefully aligned, the cores and trimmer screws hould be securely sealed. Slightly hick duco cement or nail lacquer will serve quite well. Be careful, however, not to let the lacquer run oo deeply into the threads or spread etween the trimmer plates.

FIRST TEST

Before you get that far, however, ou will have tested the set on the ench and tried to iron out any inital difficulties. For the bench test o be worthwhile, it should duplicate fairly closely the ultimate setp in the car.

The set should therefore be run rom an accumulator and the vibraor wiring arranged so that the HT olarity is correct with the frame of he set connected to either 6-volts lus or minus, whichever is the case n your own car.

Connect the set to a suitable peaker and provide an aerial comrising three or four feet of wire atached to the end of a run of light oaxial cable—about the same length s you will ultimately use in the car. A long outside aerial will give an ntirely false picture of the set's beavior, both in the matter of gain, lignment and possible vibrator hash roubles.

The possibility of vibrator hash is ne that must always be faced, hough we have done our best to anicipate trouble by specifying a cerain layout for all components. We lo not say that it is the only possible ayout, but it is one layout that works. The result of any major departures in design or layout must necessarily be on your own head.

Even assuming that our design is copied in detail, however, you may be unlucky enough to strike some residual hash and it may be necessary to spend a couple of nights experimenting with slight variations of one kind or another. You may find that an additional bypass is helpful on a B-plus or a heater line; or it may help to earth the heater line in one spot rather than another — or even in both spots together!

Occasionally a bypass appears to be better in one position than another, which is the precise reason why the final B-plus bypass in the original set appears on the receiver chassis and NOT in the power supply.

As we said on a previous occasion, "vibrator sets are a bit like that."

Chasing vibrator hash can become somewhat tedious, because you have to push the set and supply into the case each time, complete with lids, &c., before you can be sure that any steps taken have been worthwhile.

On the other hand, you may have no trouble whatever.

Based on our experience with the original set, it should be possible to turn it full on, with no earth and no aerial plugged in and to tune from one end of the dial to the other without hearing any hash at all in the output.

NO RESIDUAL HASH

With a simulated car-type aerial and lead plugged in and the set not earthed in any way, we could hear a faint trace of hash in a couple of spots. This completely disappeared behind the natural set noise when an earth was connected.

In the car, the same story was later repeated. With the set sitting on the front seat and picking up its supply from the fuse holder, there was no sign of hash without an aerial connected. With the aerial plugged in, very slight hash could be heard, which disappeared immediately the set chassis was held into contact with the car body, providing a more effective "earth" return.

Thus, in situ, the set had no audible hash whatever. One can hardly ask more than that!

Mounting the set in the car calls for some careful and obvious planning. It should be within easy reach of the driver, so that the controls can be manipulated with no more than a momentary glance away from the road. Anything more than that is likely to be dangerous.

If the passenger can do the tuning, so much the better.

In old-style cars, the normal position for a set is slung beneath the lower lip of the dash, in a position which will clear passengers' knees, as well as the gear and brake levers.

DASH MOUNTING

More recent models may have a place reserved in the dash layout for a radio and speaker and "Karset" can often be slipped into this position. Normal procedure then is to remove the front plate of the box, allowing the dial to be viewed directly through the appropriate cut-out in the dash.

The ornamental escutcheon supplied with the "Karset" dial is then placed in front of the dash and held in place by the two knobs and a couple of thin felt packing washers. With a bit of luck, the auto distributor may be able to supply knobs and fittings intended for the particular model of car.

If the "Karset" will not fit into the available space — and few sets will fit all cars — a position will have to be found for it under the dash, as already mentioned.

It is never wise to make too many

SEEN
but not
HEARD

The inspection of Mullard picture tube gun assemblies.

VOLTAGE AMPLIFYING PENTODE EF86

Low-noise pentode primarily intended for use in high-gain R.C. coupled A.F. voltage amplifier stages.

CHARACTERISTICS

V_h	6.3	V
I_h	0.2	A
C_{out}	5.5	$\mu\mu F$
C_{in}	4.0	$\mu\mu F$
C_{a-g1}	0.025	$\mu\mu F$
V_a	250	V
V_{g2}	140	V
I_a	3	mA
I_{g2}	0.55	mA
V_{g1}	—2	V
V_{g3}	0	V
g_m	1.85	mA/V
r_a	2.5	MΩ
μ_{g1-g2}	38	

OPERATING CONDITIONS

AS R.C. COUPLED PENTODE A.F. AMPLIFIER

V_b	250	250	V
R_a	†0.1	†0.22	MΩ
R_{g2}	†0.39	†1.0	MΩ
R_k	†1.0	†2.2	kΩ
$^*R_{g1}$	330	680	kΩ
I_k	2.05	0.95	mA
V_{out}/V_{in}	112	180	

* Grid resistor of following valve.
† Values ± 10%.

The Mullard EF86 is an all-glass, low noise valve, with the universally accepted single-ended 9-pin technique. The total generated noise expressed in terms of an input to the grid is **less than 5 micro volts.**

Incorporating the best features of the earlier low noise, low hum, low microphony types, the Mullard EF86, like **the picture tube,** is truly a **valve that is seen but not heard.**

Mullard-Australia Pty. Ltd.

35-43 Clarence St., Sydney. BX 200
592 Bourke St., Melbourne. MU 236

Associated with MULLARD LIMITED, LONDON; MULLARD OVERSEAS LIMITE

RADIO RECEIVING AND TRANSMITTING VALVES — TELEVISION PICTURE TUBES — ELECTRONIC PHOTO-FLASH TUBES — HEARING AID VALVES X-RAY TUBES AND ACCESSORIES — GEIGER COUNTER TUBES — CATHODE RAY TUBES — PHOTO CELLS — IMAGE CONVERTERS INDUSTRIAL POWER VALVES AND RECTIFIERS — THYRATRONS — STABILISING AND VOLTAGE REFERENCE TUBES — ELECTROMETERS COLD CATHODE TUBES — MEASURING INSTRUMENTS — SCIENTIFIC APPARATUS — RADIO RECEIVERS — COMMUNICATIONS EQUIPMENT ULTRASONIC GENERATORS — PERMANENT MAGNETS — MAGNETIC MATERIALS AND COMPONENTS, ETC.

MR3-53

ensive alterations to a car, just indulge your passion for radio. ne prospective purchaser at a er date may not see eye to eye h your ideas.

Vhichever course you adopt, it is ıost certain that you will have make up a couple of stout metal ckets, one to attach the front the set to the dash and the other support the rear end of the set. talwork like this is a nuisance, but often cannot be avoided. It does, any case, provide the very desir- e low-resistance bond between the io chassis and car.

n just a few cases, the set may into a glove-box or sit on a par- tray, without further ado. This es a lot of worry, but don't for- to provide a stout, flexible earth ap from set chassis to the car ly.

EAKER POSITION

Some thought, too, must be given the mounting of the speaker. In ny modern cars, this will mount ectly behind the dash, but, in ers, you may have to mount it a box on the bulkhead. For dash- unting speakers, the permissible e will have been determined al- dy by the car designer and you l have to buy a speaker to suit.

For bulkhead mounting, anything ween a 5-inch and an 8-inch aker will do, according to the m available. One of the current o 7-inch types is good comprom- , and suitable boxes can be pur- ased quite readily.

One manufacturer makes avail- le a speaker with a specially low ne resonance for use in car sets, e resonance offsetting to some ex- it, the limitations of small boxes baffles.

By way of illustration, we built up e speaker box shown, having out- le dimensions of 7¾ x 7¾ x 4¾ ches. It was made up from 3-8- ch ply, with a removable front. ne whole thing being nailed and ued together and left overnight to t hard.

Meanwhile, we marked out a cle on the front to suit a stan- rd 6½-inch speaker, marked in the et design and cut out the surplus od with a drill and a coping saw.

To relieve the back pressure on e cone, we drilled a couple of 1- ch diameter holes in the bottom the box, using a centre-bit.

EATHERETTE COVERING

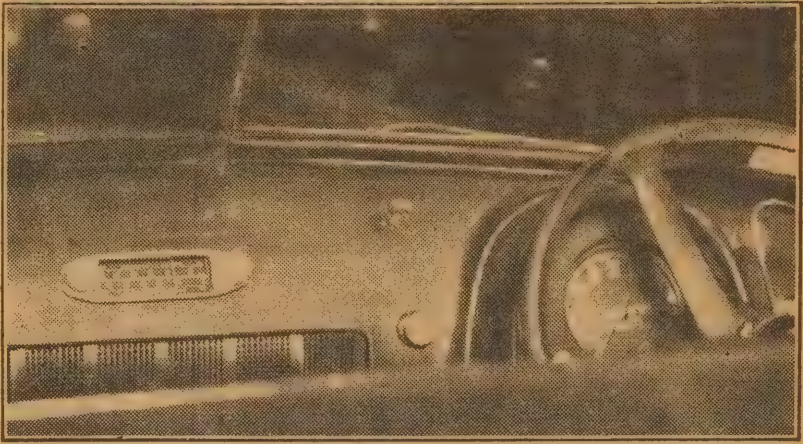
The job of covering such a box actually quite easy, even if you ve had no previous experience. It oks rather more professional than cquering. Round off all the edges d corners and smooth the surface ith sandpaper. Next, mix up a nall quantity of Casco-type pow- r glue and leave it to stand for e necessary few minutes.

You will need also a small quan- y of cheap, figured leatherette, hich can be bought readily from ather stores.

Cut a strip long enough to fold side the top front edge of the cab- et, over the top, over the back, er the bottom and around inside e lower front edge. It should be st wide enough to fold over the unded edges and lap on to the two covered sides by about a quarter- ch.

Using a knife or a flat stick, wipe thin layer of glue over the back the cabinet and lay the leatherette in place. Work it out smooth with the hands, making sure that it is square with the woodwork.

TWO "KARSET" INSTALLATIONS



The "1952 Karset" fitted behind the dash of a Holden. The new four-valve Karset would fit easily into the same space.

Next, paint glue on the top of the cabinet, running it around the front edge and inside the top lid. Smooth the leatherette into place, splitting the material far enough with the scissors to allow it to fold over inside the lip, as mentioned above.

Do the same for the bottom of the cabinet, after which you will have edges overhanging both sides, as well as surplus corners poking out the front. These have to be worked into place.

Working on one side first, paint glue on the rounded edges and far enough over the side to grip the surplus material you have left for a turnover.

With a sharp razor blade, split the material either side of the corners and fold it flat around the three edges. This will leave small horns of material yet to be folded over the rounded corners of the box. We simply cut into these a number of shallow "V's" and worked the material patiently over the rounded corners, trimming a little bit at a time.

Another typical "Karset" installation —beneath the parcel tray.

The object is to work the narrow fingers of leatherette into place so that they cover the surface of the wood without overlapping.

Do the same with all the corners until the material is in place.

The next step is relatively easy. Cut a small piece of leatherette just slightly larger than the side, allowing enough for it to fold around the front edge and inside the lip.

Paint glue on to the still exposed woodwork and run the covering into place, making sure that it overlaps the existing material all around and folds around the front edge of the box.

BUTT JOINT

When the material has settled firmly into place, hold a steel rule parallel with one rounded edge and, with a sharp razor blade, cut right through both layers of material. You can then peel away the surplus leatherette, leaving the two remaining edges to butt perfectly together.

Do the same with the other edges and then treat the two front corners to mate the two layers where they fold around. Use more glue if necessary.

Cover the other end likewise and your box is finished, apart from trimming the covering from the two vent holes.

After this experience, covering the front will not present any great difficulty.

The leatherette should simply be glued straight over the face of the fret and folded around the edges and corners, using the razor blade to fit and trim the surplus material.

This done, split the material down the centre of the frets, with a short 45-degree slit toward each corner of the centre cut-out. Glue the edges of the fret and, when it starts to get "tacky," press the material down into place. Small slits may be necessary to allow the material to follow the curve.

Gaps in the covering left by these slits can be filled later with scraps of material, but you probably won't bother with them.

Making the speaker box with a removable front allows it to be bolted

Waltham DISPOSALS!

319-321 SWANSTON STREET,
393 FLINDERS STREET,
MELBOURNE.

Address all correspondence to Box 5234 GPO, Melbourne. Write for our latest bargain catalogue.

RADIO TRANSCEIVER and INDICATOR UNIT
Approx. 180 meg. V.H.F.

Valve line up in Transceiver, Type 1045.
2—RL 18 1—RL 37 1—GL 2050 (Thyrotron)
1—VR 135 6—EF 50 2—VR 150/30 (Voltage Regulator)
1—5V4 1—6SNF 1—884 (Gas Triode)
1—EA 50 2—RL 18

This unit also contains a motor driven selector switch. Two superbly designed Polystrene, six-position, rotary coil Turrets and an I.F. Transformer Strip ideally suitable for use with Television. Band width 10 M/Cs.

Valve line-up in Indicator Unit, Type 1047.
7—EF 50 1—879 1—VR 54.

Also contains a 3000 type Relay 2000 ohms, ten assorted potentiometers, a two bank ceramic wafer switch and an illuminated scale. (5BP 1 Tube and Shield not included.)

These two Units are brand new, and are packed together in their original packing cases.

Price — £21/10/0 the two

Transceiver — £15/-/-
Indicator Unit — £7/10/- } If supplied separately.

TRANSMITTER - RECEIVERS
Type RT-34/APS-13.

Frequency Modulator approx. 450 megacycles.
Valve line-up:
9—6AG5 2—2D 21
5—6J6 1—VR 105
Also contains Dynamotor, input 27v 1.5 amp, output 285v 60 M/A.

PRICE £17/10/-.

COMMAND TRANSMITTERS.

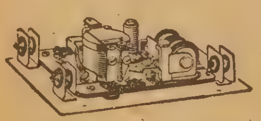
Type BC 457 4 to 5.3 m/cs. £7/10/-
BC 458 5.3 to 7 m/cs. £7/10/-
Bc 459 7 to 9.1 m/cs. £7/10/-

COMMAND RECEIVER CONTROLS.
Type BC 450.

3 Slow Motion Dials.
6 Single Pole Double Throw Switches.
4 Miniature Jacks.
3 Volume Controls, approx. 5000 ohms.

PRICE £1/15/-.

Postage and Packing: Vic. 6/-; NSW, SA, TAS 8/6; WA, Qld. 11/-.



REGULATORS AND CUTOUTS.

Made by Bendix

24v and 32v ..	£3 10 0
12v	£4 19 6

These are also suitable for tractor spares.

Postage and Packing 6/-.

ASB RECEIVERS.
800 Meg. approx.

Valve line-up:
2—955 (Acorn Triodes)
8—6AC7
1—655
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Also contains 8HF I.F. Transformers and .001, .003 Mica condensers.

PRICE £6/19/6.

ASB TRANSMITTERS.

Contain six Acorn type Transmitting Valves, High Voltage Vacuum Relays and many other useful components.

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DYNAMOTORS.

Westinghouse—
continuous running —input 24v, 5 amp;
output 575v, 160 mil.
input 24v 7 amp;
output 540v, 250 mil.
PRICE £3/10/-.

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Bendix: Input 24v 13 amp; output 300v, 260 amp.
150v, .010 amp.
145v, 50 amp.
PRICE 29/6

Western Electric: 24v. 1.1 amp input; output 250v, .06 amps.
PRICE 32/6.

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COMMAND MODULATOR UNIT.
Type BC. 456E.

Containing: 1—12J5
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1—VR 150/30
3—24v Relays
New Condition

PRICE £5/0/0

STABILAVOLT VALVES

280v 80 mil.	25/-
280v 40 mil.	20/-
150v 20 mil.	15/-
150v 30 mil.	15/-
150v 15 mil.	10/-
EF 50	12/6
VT 61	10/-
6A6	10/-
1204 RF Pentode, 6v, complete with socket	3/11

TRANSMITTER CONDENSERS

50pfd 2 gang. BUD	2 10 0
50pfd Midget Dual	1 17 6
55pfd Single junior	1 5 0
18pfd Single junior	1 10 0
25pfd Dual junior UHF	2 10 0
35pfd Single gang spaced	17 6
33pfd Max 4 mfd, min. neut. Condensers plate gap 078	1 10 0
Feed through neut, Condser plate dia. 1.27/32in.	1 5 0
80pfd per Section, dual junior	2 10 0
150pfd Per Section, dual junior	3 10 0
200pfd per Section, dual junior UHF	3 10 0

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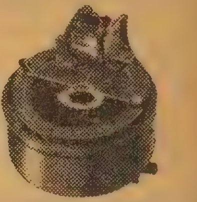
TRANSMITTING TUNING UNITS.
By General Electric

Type TU—10—B
10000 to 12500 Kcs £2/10/-
TU—7—B
4500 to 6200 Kcs. £2/10/-
TU—6—B
3000 to 4500 Kcs. £3/10/-
TU—9—B
7700 to 10000 £cs. £2/10/-

COMMAND RECEIVERS

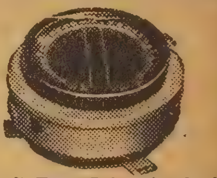
Type BC 453 190 to 550 Kcs £12/10/-.
BC 454 3-6 m/cs £7/10/-
BC 455 6-9.1 m/cs £7/10/-

TYPE 02 B COMPASS



Liquid damped, card type, 6½in. dia. by 3½in. deep, fitted with large viewing prism; ideal for craft etc., for normal navigation and also for taking bearings. £2/5/-. Packing 5/-. Freight forward.

NAVIGATIONAL COMPASSES.



Aircraft Type P.4. suitable for small sea craft, 7in diameter by 3in deep, spring mounted with adjustable circle, calibrated in degrees, liquid filled. Price £2/10/-.

Postage and Packing Vic 7/3; NSW, SA, Tas 10/6; WA, Qld 14/-

HAND BEARING COMPASS

A beautiful and extremely accurate instrument. Liquid dampened. Adjustable reading prism, complete with torch handle, for standard battery illuminates card for night use, packed in transit carrying case. Easily worth three times the price. £7/10/-. Packing and Postage Vic. 5/-, NSW, SA, TAS 7/-, QLD. WA. 8/6.

HOME LIGHTING EQUIPMENT

Utilise your present stationary engine to light your home by installing our equipment.

Our precision built aircraft Generators are ideal for this

GENERATORS

30v 50 amp Brand New, Bendix, complete with double V Pulley £25/-/-
24v 1000w Brand New, complete with double V Pulley £19/15/-

All Generators, 24v and 30v, both English and American are suitable for use on 32v home lighting systems without alteration.

Packing 5/-.

12v 500 w Type A, New	£7 10 0
12v 500 w Tpye L, New	£10 0 0
24v 1500 w Reconditioned and tested	£15 15 0
24v 1000 w Reconditioned and tested	£12 15 0
100v 600 w Reconditioned and tested	£15 0 0
12v Automatic Cutouts, suitable for 12v units	15 0

Postage on cutouts 4/-.

3½in V Pulleys, splined to fit 12v and 24v English Generators .. £1 15 0

Tandem Generators, type RLX 12v 750w, 1300 to 1600 cycles, 500w AC .. £5 0 0

This model will operate as a normal 12v 750w DC Generator without alteration.

Carbon pile voltage Regulators .. .. £1 5 0 o the bulkhead, after which the front ace, carrying the speaker, can be crewed into place.

So much then for the mounting of he speaker and the set. There remains the matter of the aerial.

These days, aerials under the runing-boards are out, as also are ornamental roof-top aerials.

Also in the minority class are those n or under the hood of fabric-toped sedans. However, some cars till on the road have such aerials lready fitted and they may as well be used. In the normal way, they are imply a few turns of wire or a metal gauze mat fitted under the abric covering, with a shielded lead rought down a pillar to the inside f the car.

METAL TOPS

An aerial of this type is handy, in hat it avoids any necessity for a urther installation, but it is naturlly not possible with cars having n all-metal top.

It should be noted, as a matter of interest, that leads to the dome light often carry ignition interference up to such an aerial, and it is desirable to break the active light lead on the dash or in the door pillar before it runs close to the aerial.

Normal procedure these days is to purchase and fit to the car a ready-made telescopic aerial.

One general type has two supportng insulators and is intended to mount on a vertical surface, as, for xample, on the cowl just ahead of he front door.

The second general type has a ingle hole base mounting and ataches to a horizontal surface, such s the top of the cowl or a wing.

The choice of aerial largely depends on the contours of the car and he wise plan is to study commercial nstallations in comparable models to udge what the usual practice is.

The ultimate length and placement f the aerial can be subject only to eneral rules. In the interests of good ignal pickup:

(1) The aerial should be as long s possible.

(2) It should be kept clear of verical pillars and panels.

(3) The shielded lead-in wire hould be as short and direct as posible.

ESSENTIAL FEATURE

While the shielded lead-in will genrally involve some loss of signal, it s generally an essential feature. Basic idea of the outside aerial and he shielded lead-in is to confine the ources of signal pickup to an area utside the car body, where ignition nterference from wiring will be the east serious. Use coaxial cable, NOT rdinary shielded wire.

It should be noted that some telescopic aerials require maintenance every few months, due to water penetrating the assembly and preventing proper contact between the sections or with the outgoing cable connection.

Unless this possibility is appreciated, loss of signal strength and intermittent noises are often blamed unecessarily on the receiver.

Having covered all these points, ou should be in a position to mount he set permanently in position and ry its performance with the car staonary. You should not be able to ear any vibrator hash, all the locals hould be at maximum strength and, in good areas, you should be able to hear some of the stronger country stations in daylight.

At night, of course, the effective range is generally much greater.

When you start up the motor, the position will probably change, due to ignition interference.

This is likely to vary enormously from one car to another, but it is not unusual for ignition interference to be heard quite loudly over the whole band, disappearing only as you tune to local stations.

The reason for this is simply that the powerful signal from the local stations operate the AVC circuit and reduce the receiver gain, thereby rendering the ignition noise inaudible.

On the weaker country station, the set gain remains fairly high and the ignition noise therefore remains audible. For precisely the same reason, ignition noises will gradually become more apparent as you drive away from the city and the signal strength from any given station begins to diminish.

Three initial steps can be taken against ignition interference:—

The first is to bypass the active six-volt lead (or 12-volt lead) at the point whence most of the circuits branch. This is usually near the fuse holder or ammeter terminal. Use a paper condenser of capacitance anywhere between 0.1 and 4 mfd. Generally speaking, the larger the condenser, the better.

The use of such a condenser involves no complication at all, and is the first obvious step to take.

DIRECT FROM BATTERY

Another possible step is to take the power from the set directly from the active terminal of the battery, rather than from a more remote point in the wiring. Such a step often reduces ignition troubles and also avoids loss of headlight brilliance due to added voltage drop in the leads.

It does, however, falsify the ammeter reading and this may be significant for night driving. If the ammeter happens to show a charge of, say, 4 amps with the headlights on and the receiver is drawing 5 amps directly from the battery, then the latter will actually be suffering a steady discharge of 1 amp.

The third and major weapon against ignition interference is undoubtedly the use of ignition suppressors fitted to each plug or a single suppressor fitted to the centre lead to the distributor.

The effect of suppressors has been debated at length, but the general truth seems to be that they will not noticeably affect the performance of any car whose ignition system is in good order. Where the spark is already weakened by poor adjustment or by poor insulation, the use of spark suppressors may well represent "the last straw."

By the use of one or more of these three measures, all of which are fairly simple, it is generally possible to get the ignition noise down to a level where it is not audible at all on local stations and even on one or two of the stronger country stations.

For country driving, reception of the strongest available stations may be satisfactory, except in remote areas.

To render a car completely noise-free involves chasing many second-order effects and you may or may not be willing to tackle the job. Whether you are ever likely to need to depends on your own driving and listening habits. Do you drive into remote areas and do you want radio, if you do?

If your answer is a double "yes," then you must be prepared to chase the lesser sources of noise injection, related to the ignition system, the generator, electric gauges and moving parts of the car as a whole.

As a guide to tracking down some of these less obvious interference troubles, we simply list again in brief some of the points mentioned in earlier "Karset" articles. They are merely general suggestions, which may or may not apply to your particular car.

Firstly, more about ignition noises:

Shield the HT lead from ignition coil to distributor, grounding the shielding.

METAL COVER

Ground the metal cover of distributor to the engine block.

Bypass either one or both LT terminals on the ignition coil.

Bypass one or both terminals on the ammeter.

Provide a metal tube or other shielding to enclose the spark plug wiring, earthing the tube to the engine block. Already installed in many cars.

Remove low tension wiring, already in such a tube, leaving only the HT wiring enclosed. Tape LT wiring along the outside of the tube.

Shield leads to the ignition coil primary. Try reversing ignition coil primary wires.

Lengthen the distributor rotor with solder to reduce the length of spark.

Shield all low-tension wiring between the ignition coil, switch and ammeter, behind the dash.

The generator is another potential source of interference which may vary from a rough sparking noise to a whine. Check this by revving the motor to a high speed, switch off the ignition and see if noise is still evident. Accepted measures are as follow:

Bypass generator output terminal.

Clean commutator with fine sandpaper.

Have commutator reconditioned and trued-up, also brushes.

Have insulation between segments slightly undercut.

Bypass one or both ammeter terminals.

Bypass cut-out terminal connecting through to the ammeter and battery.

ELECTRICAL BONDS

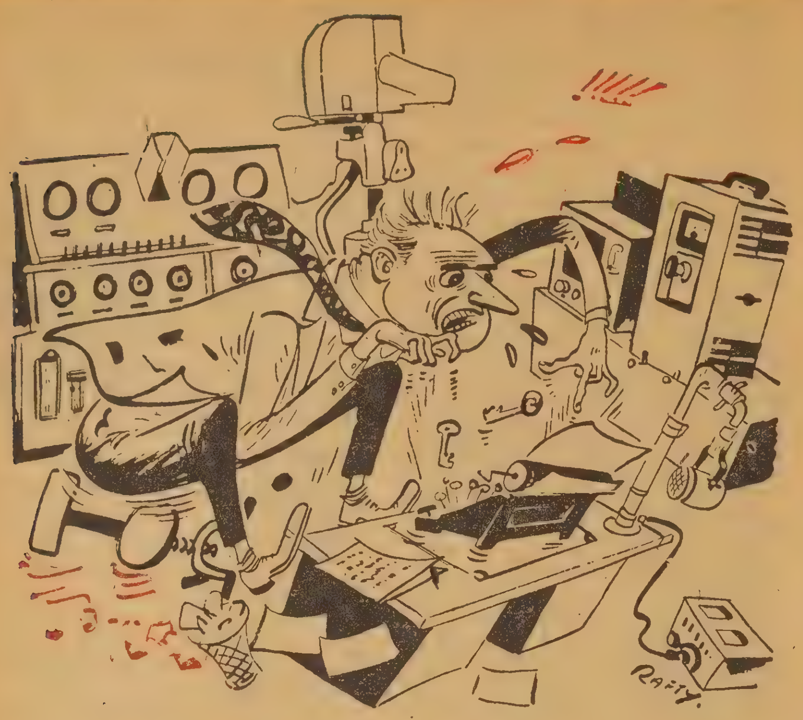
Because the requirements of car radios were not foreseen, manufacturers have not always electrically bonded the various portions of a car framework.

Potentials can thus accumulate between various portions of the body and chassis and these potentials discharge periodically, producing interference not unlike ignition noise, but not possessing the same rhythmic beat dependent on motor speed. Scratching sounds may also result. Careful bonding may minimise ignition noise into the bargain!

Check the need for bonding by making firm contact between different parts with a stout wooden-handled file. If permanent bonding is necessary, use woven copper strap of the heaviest practical type.

Bond to the bulkhead all control

(Continued on Page 76)



Let's Buy An Argument

For some weeks past I have been jotting down on scraps of paper a number of items which might well be grouped under the heading of "Things The Textbooks DIDN'T Say". Had there not been the risk of being thought conceited, I might alternatively have chosen the heading "Traps For Young Players".

by W. N. Williams

WHAT brought up the whole subject was a telephone call from a very good friend, who started off with the expressed intention of having "a bit of my ear".

This said friend had originally been enthused by our article on the "Wide-Band Tuner" and decided forthwith that he must have one. He duly bought all the necessary parts and sat back one evening to "digest" the article and circuit before going ahead. A very worthy intention, might I add!

It so happened, however, that there arrived about the same time his copy of a new textbook and he sat down for some further evenings to see what he could glean from its pages.

What he learned discomforted him greatly:

(1.) The "Wide-Band Tuner" used a diode detector and diode detectors could introduce many percent of distortion. They mightn't be able to handle signals more deeply modulated than about 50 pc.

(2.) The "Wide-Band Tuner" used only simple AVC, whereas it seemed such an obvious thing to use delayed AVC.

(3.) Delayed AVC had its troubles too but they could be overcome by using a three-diode arrangement (making the whole circuit so much bigger and better).

At this stage he had just about made up his mind firstly to have "a bit of my ear", as aforesaid, and secondly to redesign the tuner to make it "really good".

Since the first resolution was the easier one to follow, he picked the phone and dialled the appr priate number.

Now don't get me wrong. I'm n in any way trying to ridicule the m in question. He's a very good frie who has travelled far and kno a lot more about a lot of things th most people. Besides, he's a bigger than I am!

What I am trying to emphasise simply that there is often more these designs and discussions th meets the eye, or is apparent fr first reading of a textbook.

Well, then, why hadn't we us delayed AVC?

WHY DO IT?

Simply because there was no gre point in so doing. The "Wide-Ba Tuner" was designed expressly f the reception of strong local statio either in the cities or in well-serv rural areas. I must emphasise t "well served".

Where the signals are weak, copious pass band leaves it wi open to night-time "joeys" a whistles, as well as all the electric and atmospheric noise that the ant radio gremlins have so kindly pr vided.

It is certainly true that, in favo able locations, the tuner has enoug sensitivity and selectivity to bri in a fair selection of distant statio but this is somethng extra that yo get for nothing. It was never a initial requirement of the origina design.

Well, then, since we were not interested in encouraging the use o the tuner for listening to wea signals, there was no point in building into it a bit of circuitry whic could only refer to weak signal conditions.

My friend was inclined to haggl a bit at this. But why not use delayed AVC anyway? If the AV diode were fed from the IF amplifie plate, there would be that muc less loading on the detector circuit.

But it isn't quite as simple a this. There could be no delaye AVC without a delaying bias, an this would have meant an artificia bias at the cathode of the AVC diod or a negative back-bias at the en of the AVC load. And how ca you get a back bias in a tuner tha draws its supply from somewher else? You would have to sta fiddling with the amplifier's ow power supply.

Then, again, we weren't keen to un extra AVC wiring to the IF mplifier plate. One of the obvious oints about the tuner was that its erformance could be ruined by regeneration in the IF stage and every xtra inch of lead on the plate would increase the chances of it.

In straining at a gnat, we might asily and unwittingly have swallowed a camel.

And, of course, by using delayed AVC, we would be left with an neasy feeling about the distortion rising when the second diode just egins to conduct. Hence the three diodes that the textbook went on to mention.

The whole thing would begin to look awfully complicated.

Finally, what about the diode detector distortion?

Well, the DC load is 0.25 meg. It could actually go lower if need be.

Across portion of this is shunted the 2.0 meg AVC feed and the input mpedance of the cathode follower. But this latter isn't 1.0 meg. Its ffective loading is nearer ten times hat value.

DISTORTION NOT HIGH

The net result of all this is simply that the distortion of the detector, so loaded, is very little diferent from the natural unloaded iode. Very different from some of the undesirable circuit arrangements mentioned in the said text-book.

As for the distortion at 100 pc modulation, it is extremely doubtul whether this degree of modulaions is approached in the IF signal f a practical tuner.

As we pointed out some months go, a much esteemed writer in Wireless World analysed the operaion of a high frequency amplifier tage and concluded that there was resent a natural de-modulation efect, which probably meant that the etector was never called upon to andle anything more than about 90 pc modulation at the very outside.

But why bother with a diode at ll? Why not use a reflex detector nd be done with it?

The answer to that was very imple:

(1) Reflex detectors don't give AVC, and we want AVC to avoid subsidiary control.

(2) Reflex detectors have a negative input impedance which would be a nuisance in this tuner.

PUZZLED ABOUT SIDEBANDS . . .

In April, 1952, you pointed out that ABC stations regularly test their frequency response up to 10 Kc, and then concluded.

"In other words, as far as the engineers are concerned, the line and transmission equipment is substantially flat overall to 10 Kc."

Then referring to "the frequency range of the actual programs which the stations radiate" you state: "Programs from average to good, 78 rpm discs are usable up to about 6½ Kc. Surface noise and inner groove distortion is ofte nserious and is often filtered anyway at the station."

And again: "Microgroove records will generally be good to 8 or 9 Kc and we'll swear to a few programs running up above 13 Kc."

Now in Australia, as in America, the separation between adjacent channels is 10 Kc (in Europe the figure is, I believe, 9 Kc.)

On referring to Ghirardi's "Radio Physics Course", page 69, we find plotted the audio frequency transmission characteristics of a broadcasting station and, like the ABC stations, we see that it is "substantially flat overall to 10 Kc."

But, in commenting on the response curve, Ghirardi says, "Notice the almost flat transmission curve between 40 and 10,000 Cycles for the modern 50 Kw transmitter. Although these are designed with a sound frequency range up to 10,000 cycles, they do not actually broadcast anything above 5000 cycles. This is due to the fact that there is but a 10,000 cycle (10 Kc) band between adjacent station carrier-frequency assignments, and since both sidebands are broadcast, frequencies above 5000 cycles begin to overlap those of the station on the next assignment.

Now, I know that the ABC have 6½ Kc cut-off filters under their 78 rpm turntables; but if Ghirardi's comments hold good these must be simply for the benefit of their own monitor loudspeakers and their FM transmitters.

And, if the stations transmit nothing above 5 Kc there is not so much need for very wide-band tuners. For instance, according to your curves, a standard 455 Kc superhet using RCS IF's is only 5 db down at 5 Kc. It shouldn't be very hard to bring the overall response of the receiver back to reference at 5 Kc by a little boost in the audio end.

Now what is the truth in this matter? Is H. A. Hartley nearer the truth than you suspect? Or have conditions changed since Ghirardi wrote his famous Radio Physics Course", in 1933? Yours faithfully, E.M.H.

HAS COME A LONG WAY . . .

For some time now I have been particularly interested in Audio progressing from an extremely hazy knowledge through to a reaonable understanding of the complexities of this most fascinating hobby.

As the means of procuring the essentials of theory, I followed the Learn While You Build series and then made my first step into the Audio Sphere via the Playmaster Baby used in conjunction with a flat-baffled 8in Rola & Garrard single speed unit with their heavy crystal pickup.

I have lately finished off the Playmaster No. 2 and am using it in conjunction with a Rola 12/0 in a vented enclosure of my own construction (shaped for the corner of a room). My pre-amp is the Playmaster No. 2 and p.u. an Acos GP 20.

I am feeding the p.u. through the T-pad recommended by you and thence according to the circuits of the Pre-Amp and Playmaster No. 2 Amp. I have used a 1 Pot. as load for the p.u. and I have selected a position which gives me plus or minus 0 for 50 c.p.s.

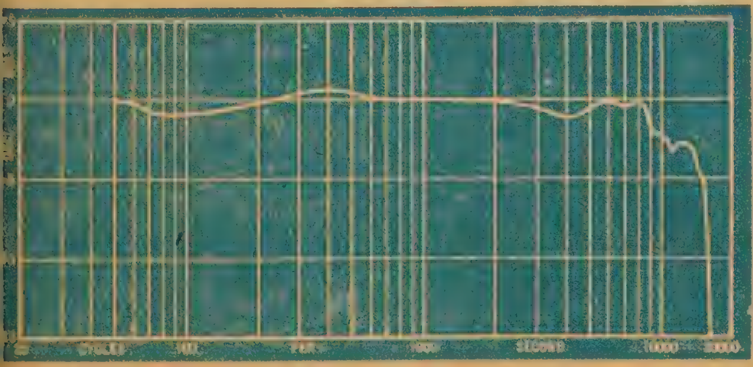
A curve which I took yesterday may be of interest to you and I am attaching a copy. Naturally I am very pleased, indeed, with the results.

I am afraid the curve was taken under anything but really accurate conditions maybe due to lack of suitable equipment. The test record was an HMV with 50 cps at 14 db. as the lowest frequency rising to 2000 c.p.s. at plus or minus 0 db.

When taking readings I used an AC voltmeter on 0-10 V scale with speaker disconnected and a three-ohm load to match the O.P. transformer (incidentally an O.P. 64). I adjusted the load to give me plus or minus 0 db. at 50 c.p.s. and 1000 c.p.s. and proceeded to take the remaining readings with the gain wide open and playing "straight through" (no bass or treble boost or cut) except for the circuit giving compensation for the recording characteristic.

I can vouch for the authenticity of the curve as my wife assisted me in checking.

If you can spare the time to make any comments I would appreciate them very much. Sincerely, R.P.



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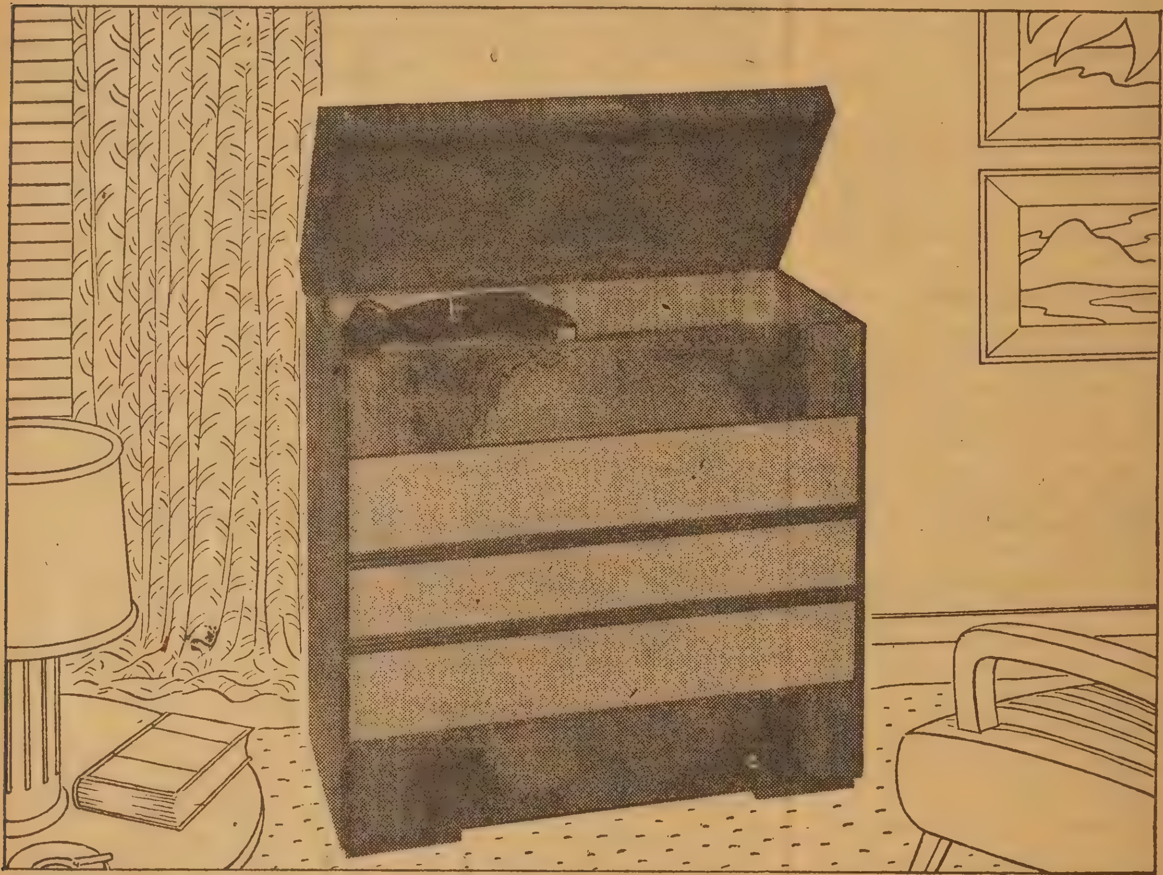

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Q'land Representative: N. C. Tritton, Perry House, Adelaide St., Brisbane.

LET'S BUY AN ARGUMENT

(Continued from Page 73)

(3) There is no guarantee that istortion would be lower.

To quote the same textbook, "With iaximum degeneration and stable perating conditions, the distortion ; about the same as for a diode perating under similar input voltge conditions . . ."

To round off the story, my friend ecided to build the tuner in its riginal form. I went on to assure im for good measure that it was ie best "fidelity type" tuner I had ver handled, and was generally cknowledged as such by most eaders who had built it.

It had even been adopted for use s a broadcast monitor in certain fficial circles:

Knowing his requirements, it ould do just what he wanted of it.

HILOSOPHY (?)

If one might wax slightly philosphical for a moment, before degning any equipment or even selcting a design one must (in the ords of editor John Moyle) "state ie operational requiremens."

Behind these simple words is a hallenge to mental honesty that can ave one a lot of time and worry and ven a lot of money!

Take this matter of tuners, for exmple. To the question what kind f a tuner do I want, most of us re inclined initially to answer . . . one with everything." Variable electivity, low distortion, all-band overage, bandspread where you ant it, even a BFO to receive iorse!

All very ambitious but would you se all the facilities if you had them? Iow often do you listen to interstate ations? How often do you listen on iort waves? Could you listen on the iort waves anyway when the rest f the family are interested in the cal programmes?

By the time you analyse honestly few questions like this, you may ave to admit, for example, that our real need is for a good local ation tuner in the living-room. ou may later build a separate DX eceiver that will allow you to inulge your own listening habits unampered . . . if you have such habits! hat becomes project number 2.

The result is obvious. Because you re honest with yourself, you end p with a tuner that is far easier nd cheaper to build, far easier to djust and operate and much less kely to go wrong because it has ewer parts.

NORMOUS AMPLIFIERS

Then again how many enthusiasts ave spent lots of money building iormous amplifiers when they knew eforehand (but wouldn't admit) iat "Mum" would growl if they ver turned it up beyond half a watt.

I'm not trying to talk down big iings. Sometimes big things are ecessary or desirable. I'm just sugesting that we define our requireients carefully before embarking i any new project.

"But," you say, "I like building ig amplifiers; I like building big iners. It gives me a sense of satisiction."

That's fine. It simply means that your "operational requirement" become a medium for self expression, with time and money and complexity no object. In fact, the more frills and chrome plate you can add the better you'll like it.

All this, mind you, because a friend wanted to add delayed AVC to our pride and joy tuner.

Referring now to the letter "Puzzled About Sidebands," I'm wondering whether I am doing the correspondent an implied injustice or whether I should cast aspersions instead on the contents of the textbook. From as much as is quoted, there does seem to be room for query.

Ghiradi's contention apears to be that broadcast stations cannot—and in fact do not—broadcast audio frequencies higher than half the separation between adjacent channels, expressed in Kc.

This would simply mean that the highest frequency which you could hear from any Australian station would be 5 Kc., since the nominal separation between adjacent channels is 10 Kc.

It would also mean that our preoccupation with wide range tuners and audio filters is so much eyewash.

If all Australian stations were concentrated in one small section of the continent, there might be some justification for the contention. It might even apply as it is in some countries.

RECEIVERS LIKEWISE

Jammed up together, in this way, stations might conceivably have to limit their maximum modulation frequencies to 4½ or 5 Kc. But don't forget that the receivers would likewise require a rectangular-shaped pass band to retain good intelligibility and yet not "hear" sidebands a few hundred cycles away. The mere doctoring of transmitters would not be enough.

But I think it's a rather unreal picture.

In actual fact, Australian stations are distributed over the whole face of a continent and, by and large, listeners in any given area derive their service from only a few stations. The rest of the stations are relatively weak.

In allocating licences and frequencies, the authorities have tried to isolate the transmitters as far as possible so that the effective separation between stations serving any one area is a lot more than 10 Kc.

This allows the stations to radiate all the available modulation frequencies and listeners in their intended service area can take advantage of them by using suitable receivers.

It may be perfectly true that the sidebands overlap stations on adjacent channels but what are the odds if the said stations are a thousand miles away and so weak as to be of no account? Nor are the activities of your local station likely to worry listeners to the other two.

The difficulty arises, of course, in areas where the signal from the desired station cannot swamp out the signal from the interfering station. The overlap in the sidebands can then be heard, giving rise to the classic term "monkey chatter."

The only possible defence in such a case is to use a normally sharp receiver, which generally reduces the interference to a degree that renders it no longer important. The listener is then little or no worse off than if the station itself had applied a sharp cut-off.

So, E.M.H., Ghiradi notwithstanding, let it be said that Australian broadcast stations do radiate whatever modulation frequencies they can reasonably squeeze out of their programme sources and their equipment. Our estimate, as quoted, is pretty close to the mark.

RESPONSE (?) CURVES

Therefore there is everything to be gained by building a wide-range tuner, provided you are inside the strong service area of your desired stations. If not, you'll be happier with a more selective receiver.

Now for the letter from R.P. and his rather arresting claims about overall frequency response.

When I read his letter and looked at the curve, I remembered a telephone conversation a few weeks earlier that would otherwise have been forgotten.

Over the telephone, someone asked whether the tuned filter as designd for the Acos GP20 could be used to advantage with a "turnover" type pickup. I said not, because the two general types show distinctly different response characteristics.

The GP20 has an honest and fairly consistent peak in the 6 Kc. region, which can be tuned out to leave the overall response fairly flat. Most turnover pickups, on the other hand, show a much more erratic curve, due to the inter-related resonance effects of the active and the idle stylus.

He then went on to tell about a curve taken with one of these pickups, a standard test record and an output meter. It didn't vary, he added, by more than a decibel or so over the whole range.

BEST EVER

I was puzzled but left him with the rather facetious suggestion that he had acquired the best turnover pickup that had ever been made.

On top of this came the letter from R.P. I began to think about it.

Where on a voltmeter scale did the "O db." mark normally occur? I had a look . . . 5.8 volts!

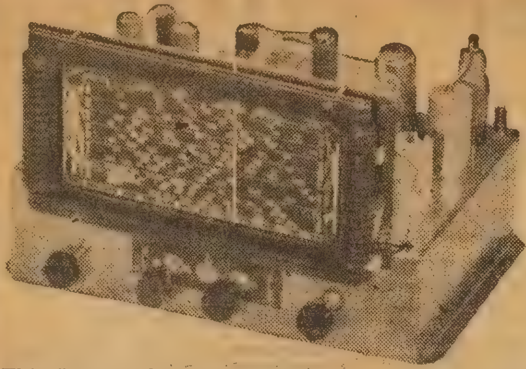
Now if an amplifier were turned up to deliver 5.8 volts into a 3-ohm load, it would represent a power output of over 11 watts. Into a 2-ohm load it would be nearer 17 watts. The amplifier in both cases was a push-pull 6V6 job and either figure at the secondary would represent an overload, with a badly flattened wave form.

To support the notion, R.P. specifically states that he set the volume "full on," presumably to avoid capacitance loss in the control. Most likely it would overload anyway.

Having then been set beyond overload point at 1000 cps, the effort of peaks in the pickup only would be to increase the degree of flattening in the waveform with but little change in the output voltage.

Similarly, troughs in the pickup response would not show up to full advantage till the output dropped below the overload point. A kind of peak limiting circuit.

(Continued on Page 91)



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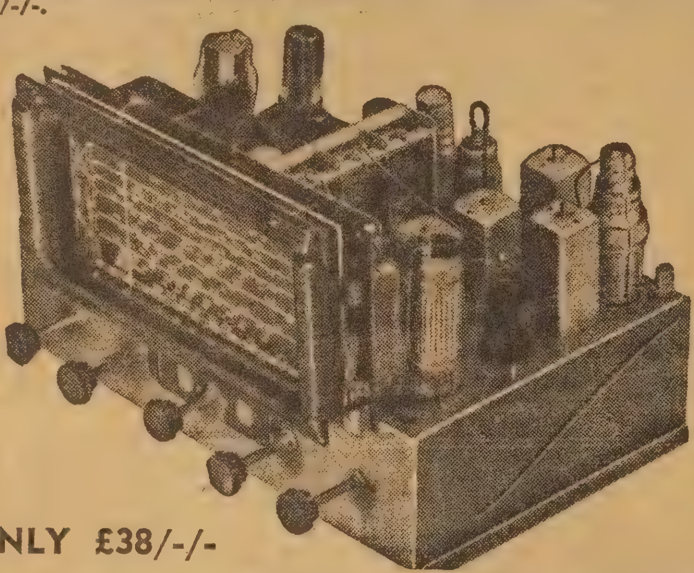

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R & H "KARSET'

(Continued from Page 71)

rods which pass from the engine i
side the car.

Bond the transmission and th
exhaust muffler to the chassis.

Check earthing of the rain gutt
around the hood and the metal su
round of the windscreen. Bond
frame if necessary.

In early models bond body pane
to chassis. Also the dash to chassis
Bond steering column, dash an
chassis.

Ground door jams and windo
mechanism to the mounting pillar.

Bond rubber-mounted motors
the chassis.

Bond the engine hood to bulk
head.

Bond speedo-cable, oil-pressu
line and fuel-gauge line (pneumat
type) to the instrument panel.

Bond the engine splash-pan
chassis.

And here are a variety of gener
precautions which may prove help
ful in some obstinate cases:

Bypass starter switch on th
starter side.

Ground securely the windscree
wiper (pneumatic tube).

Experiment with shielded aeri
lead-in. Try intimate bonding
chassis frame, or bonding at eac
end only.

Bond metallic foot plates to chass
or try an earthed sheet-metal shiel
beneath the front mat — especiall
if noise increases when passenge
occupies the front seat.

Bypass one or both sides of fus
and fuel gauge.

Re-wire the ignition switch to cu
the "hot" side of the primary circui
not the earthed side, as in some earl
models. Shorten the hot lead as fa
as possible, and shield in some case

Mount the ignition coil on th
motor side of the bulkhead.

Bypass one or other cut-out ter
minal.

One final thought: Where prac
ticable, make all your interferenc
checks with the motor bonnet close
It's surprsing how often this i
overlooked and equally surprising i
the effect it can produce.

RADAR TECHNIQUES

(Continued from page 59)

By means of this relationshi
radar system designers can reason
ably predict the performance of
proposed equipment.

Note that the range varies as th
fourth root of the other factors. Th
arises since the signal traverses th
path twice, so that the received signa
is inversely proportional to the fourt
power of the distance rather than th
familiar inverse square law of one
way transmission. For this reaso
very high transmitter powers an
very sensitive receivers are neede
for satisfactory radar operation.

Fortunately, the pulsing techniqu
required for ranging also makes pos
sible the generation of peak powe
of far greater magnitude than coul
be obtained by continuous wave os
cillators. Pulse powers of hundre
of kilowatts are in common use. Sub
sequent issues of this series will dis
cuss means of generating and radia
ting such energy. (Aerovox Resear
Worker.)

TRADE REVIEWS AND RELEASES

A NEW COMPARATOR TYPE C-R-L BRIDGE

Robinson Electronic Laboratories announce the release of a new type comparator C-R-L bridge which is designed to present many features hitherto found only in much more expensive and delicate laboratory type instruments.

ONE of the main features of the instrument, which will be appreciated by anyone who has had experience with normal types of bridges, is the use of an extremely sensitive, but at the same time quite foolproof, null indicator. This is achieved by means of dynamometer movement designed to saturate quickly as it deviates from the null point, thus making it impossible to overload the movement with any degree of unbalance.

The instrument is designed to measure resistance, capacitance, and inductance, using internal standards in the first two instances and external standards for inductance. Two internal standards allow capacitance to be measured from 10 pf to 10 mfd while the range may be extended by means of external standards.

Three internal resistance standards enable measurements to be made from .1 ohm to 10 megohms, while this range may also be extended by means of external standards.

At right is the new C-R-L comparator type bridge announced by Robinson Electronic Laboratories. It is well finished in a grey crackle case, while liberal use has been made of colors on the dial and panel to assist the operator in selecting the correct scale.

Tested in our laboratory the instrument appeared to completely substantiate the makers' claims and to be a well-made precision instrument.

Price £31/10/- plus sales tax.

A HIGH-CURRENT SWITCH DECK

PATON ELECTRICAL PTY. advise that they have recently developed a new rotary selector switch to meet the need for a switch of sufficient current rating for use in the wide range of electrical testing equipment made by this firm.

There should be many applications for a switch of this type in the radio, electrical, and automotive fields, where a switch combining small physical size with high current rating is required.

The switch is rated to carry between 10 and 15 amps and to have a contact resistance of only 800 micro ohms. The insulation is designed to withstand 1000 volts between poles or frame.

The contact arrangement may be a 12-position single-pole, six-position two-pole, or three-position four-pole. Other combinations may be obtained on application to the makers.

A sample switch was submitted to us for inspection and appears to be a very well made unit. Physically it appears to be interchangable with the well-known Oak type switch and could be accommodated in the same space normally allotted for one of the latter. It should also seem possible to mount the wafers on the same shaft as an Oak type

GOODMANS SPEAKER

UNITED RADIO DISTRIBUTORS PTY. LTD., 175 Phillip St., Sydney, wish to correct an error which occured in their recent advertisement for the new Goodmans Axiom 150 Mk. II. In this it was inadvertantly stated that the cone resonance was 45 cps, whereas it should be 35 cps. This difference would be quite important to anyone designing a vented enclosure.

The new speaker is fitted with a carefully designed magnet assembly using anistropic material which provides a total flux of 158,000 maxwells on a 1¾in pole. The back centreing device is a dustproof bakelised linen disc with concentric corrugations.

The combination of these features gives this loudspeaker a smooth coverage from 30 to 15,000 cps with bass modulation effects reduced to a minimum.

The manufacturers, Messrs. Goodman Industries, emphasises that, owing to the wide frequency coverage of the unit, it is important to remember that the ultimate quality of reproduction depends also upon the degree of perfection of the input to the loudspeaker. Distortion introduced in the program material, the pickup or the amplifier is emphasised by a wide-range speaker.

NOTES IN BRIEF . . .

- Aegis Manufacturing Co. advise that they are now supplying case hardened drilling jigs designed to simplify the task of drilling mounting holes for Aegis midget coils. Normally the laying out and drilling of these holes is a tedious task but, with the aid of the new jig, it becomes quite simple.

Another important feature of these jigs is that they are supplied FREE to all purchasers of Aegis Car Radio Coil Kits and regular users of Aegis Midget Coils and IF's.

- A. G. Healing Ltd., of Melbourne, announce that they have recently released a 5-valve receiver using the same style cabinet as their 4-valve model, Em-Cee 4. The new model is to be known as model Em-Cee 5. Retail price is 25 guineas.

They are also pleased to announce that their Personal Portable Model 404B has been reduced in price to 19 guineas.

- A plastic drawing instrument called the "Quickdraw" has recently been placed on the British market. It consists of a transparent template carefully cut with mathematical accuracy to produce angles, triangles, and rectangles, either in inches or millimetres to scale. It will also produce circles from ⅛in to 1in diameter.

The template is fastened by a toggle hinge to form a pantograph and the whole is securely fixed to a base which also serves as a drawing board which is 14in square. Further details can be obtained from the agents, F. & D. Brownlie, 56 Grange Rd., Ealing, London W5.

AMERICAN RADAR TRANSMITTER
Type ASB

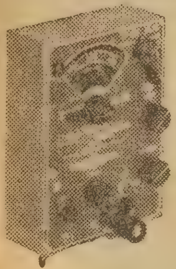
Contains:—

Two U.H.F. Triodes Type 15 E.
One High Voltage Rectifier, Type 15 R.
Four Sets of Lecher Bars.
Transformers, ceramic mountings, Motor Blower, etc. Also High Voltage Vacuum Change Over Relay. Nominal frequency 515 m/cs. Ideal for conversion to U.H.F. Channels. Variable Coaxial Cable and Link Matching Lines. Contained in Aluminium Case, dimensions 18in x 7in x 8in.

£3/17/6

Freight extra.

New MN26C Radio-compass Accessories



CONTROL BOX	37/6
FLEXIBLE DRIVE, 6in	10/-
FLEXIBLE DRIVE, 24in	18/6
ASMITH INDICATOR	37/6
COMPASS LOOP AERIAL	30/-
LOOP CABLE WITH PLUGS	25/-
ASMITH-CABLE WITH PLUG	15/-
MR 15A CRANKS	7/6

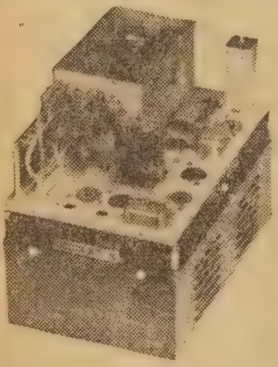
ALL PLUS POSTAGE

NEW BEAM ROTATOR

Originally a propeller feathering motor. These units are ideal for rotating beams. A gear box ratio of nearly 10,000 to 1 gives this unit terrific power. 24 volts DC input will operate on A.C.

£8/15/-

Freight extra.



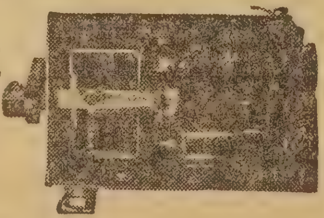
19/6

PLUS FREIGHT
BY PASS. TRAIN ONLY

I.F.F. CHASSIS
CONTAINED IN ALUMINIUM CASE

H.F. Oscillator, frequency approx. 200 m/c complete with two 7193 valves. I.F. transformer. 10 high insulation octal sockets, 45 insulated carbon resistors, mainly 2 watt, 24 paper and mica condensers

H.F. Oscillator



Frequency approx. 200 m/c Adaptable to the 144 m/c Band. Complete with 2-7193 Valves.

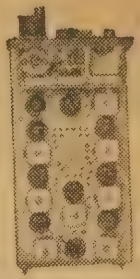
Type "B" 12/6

POST FREE

METROPOLITAN RADIO SUPPLIES

479 Parramatta Road, Leichhardt, N.S.W.
(At top of Taverner's Hill)

AMERICAN H.F. RECEIVER ASB4



Complete with 11 tubes 7 6AC7, 2 6H6, 2 955 acorns. Can be altered to 144 or 280 Mc amateur band or FM band.

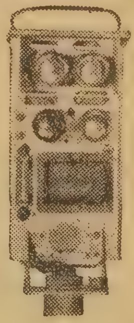
£7/17/6

Freight extra.

COMMAND RECEIVERS

Low frequency command receivers. 195 to 550 kc
Complete with 6 tubes. **£9/17/6**

NEW LUCAS ENGLISH GENEMOTORS



Input 12V. Output 250V at 65Ma
Supplied with input filter.

£2/10/- Postage N.S.W. 6/6
Interstate 8/9

FOUR VALVE AMPLIFIER

American amplifier complete with two 7C5, one 7C7 and one 7Y4 valves in brocaded aluminium case.
(No power supply)

Postage N.S.W. 6/- **27/6** Interstate 8/6.

A.C. AMP METERS

A.C. Amp. Meters (ex-County Council). A necessity in any electrical workshop
RANGE. 0-5 amps. (can be extended by shunts).
MOVEMENT. 300 degrees.
SCALE LENGTH. Nearly 15 inches.
DIAMETER. 7½ inches. **37/6**

Plus postage.

PRECISION TIMERS

48-hour jewelled movement suitable for repetition timing over periods of one minute. Ideal for photographic work, electric sign switching etc. New in cartons.

22/6 Postage 4/- extra

PORTABLE TEST SET

Containing 2½-inch 0-50mill meter, six-point key switch, &c., in case.

£1/-/-

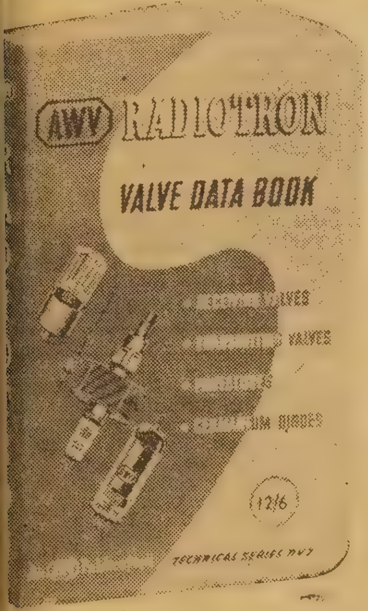
Postage: N.S.W., 4/6; Interstate 3/6.

VALVE DATA BOOK

The Amalgamated Wireless Valve Co. have just announced the release of a new valve data book which should be of interest to all engineers, servicemen, amateurs, and home builders.

'HE book is intended to bring up- to-date all previous published lve data, and to present it in a anner which will make the parular information required read- available. To this end the data the latest valve types has been vised where necessary to embody small modifications and additions operating data, which have been own by practical application to be sirable.

At the same time older type lves have either been omitted mpletely, where it is considered at there is no longer any interest them, or covered in lesser detail, ere the interest is only likely to occasional.



As well as current receiving valve es there are chapters devoted to nsmittitng valves, phototubes, and manium diodes.

The transmitting valve section ocpies over 100 pages and covers ves suitable for both medium quencies and VHF either in amar or industrial fields. Many ders will find this section alone sufficient interest to justify purasing the book.

The data on photo tubes will inly interest those interested in lustrial electronics and motion ture sound reproduction, while germanium diode section will ove of value to the engineer and perimenter. . . .

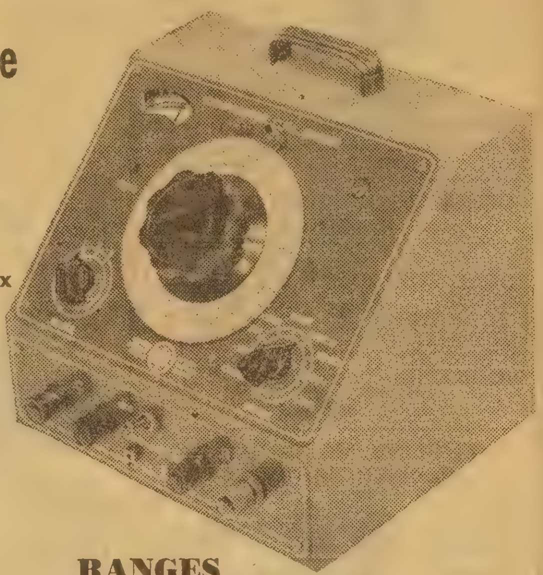
Adequate stocks of the books are ilable from all technical booksell- or from the publishers. Amalnated Wireless Valve Co., 47 York , Sydney. Sydney price, 12/6, post e.

MEASURING C.R.L. BRIDGE

With wide range of applications and pointer type indicator.

Amazing Value for only £31/10/0

plus 12½% sales tax



As an extension to the range of Electronic measurements offered by the well known R.E.L. Electronic Multimeter, the CRL Bridge forms a logical development.

RANGES

CAPACITY

With two internal precision standards, capacitance can be measured from 10 mmfd to 10 mfd. External standards (not included) can extend this range down to 1mmfd (with due precautions for stray capacitance) and to any desired value above 10 mfd.

RESISTANCE

With three internal precision range (wire wound on two lower values) resistances can be measured from 0.1 ohms to 10 megohms. With external standards upper range can be extended to several thousands megohms.

GUARANTEE

We supply written guarantee covering each of our instruments for six months.

ELECTRONIC MULTIMETER and PROBE (V.T.V.M.) with DECIBEL METER

£37/10/-

Plus 12½% sales tax.

Specialising in Electronic Multimeters and VTVM's, R.E.L. has developed an instrument of high quality, dependability, accuracy, and versatility, simple to operate, and selling at the most reasonable price possible.
This attractive 32 range instrument is fully guaranteed, and measures resistance from 0.2 ohms to 1000 megohms in five steps, D.C. voltage from 0.1 volt to 1800 volts in ten steps, A.C. voltage between 20 cycles and U.H.F. Spectrum from 0.1 volt to 600 volts with internal diode or external probe.
The decibel range is from —18db, to +5db., and from +2db. to +25db.
The imput impedance is 10 megohms and up to 30 megohms on the D.C. x 3 ranges.

ROBINSON ELECTRONIC *Laboratories*

Telephone UA 1154

REL

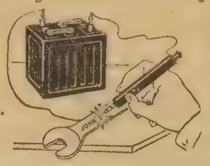
107 PARRAMATTA ROAD. HABERFIELD N.S.W.

NEAR LIVERPOOL ROAD, RING, WRITE OR CALL FOR INFORMATION

ELECTRIC ENGRAVER

What everybody has been waiting for. An Electric Engraver that works off your car battery.

Engraves anything in metal.



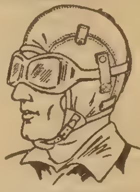
Ideal for name tags, dog collars, plant labels, etc.

29/6

Engrave your name on all your tools. Marked tools are never stolen. No Garage should be without one.

GENUINE AMERICAN FLYING HELMETS

IDEAL FOR MOTOR CYCLISTS AND ALL OUTDOOR WORKERS.



BRAND NEW, 15/- EACH

ENGLISH MOTOR AND BLOWER, 24 VOLTS

39/6

Will Work off 32-volt Lighting Plants.

Larger size also available that will work off 12 or 24 volts, £3/15/-.

AMERICAN VACUUM or AIR PUMP

Builds up air pressure to 20lb at 1000 R.P.M. Develops up to 120lb of hydraulic pressure, will pump 7½ gallons S.A. E. oil or other liquids per minute. Useful for spraying, milking presses, oil burners, hydraulic systems. £3/15/-

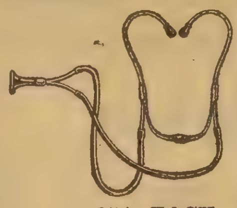
ENGLISH ARMY SPOTLIGHTS

IDEAL FOR SHOOTING. FIT ONE TO YOUR CAR.

6-volt, 37/6. ... 12-volt, 25/-
Fitted with Mirror Reflector.

MECHANICS' STETHOSCOPES.

Ideal for Testing Engines.

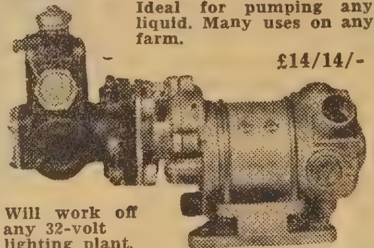


35/- EACH

Lucky Repurchase! Aircraft 24 volt motor complete with 400 gal. per hour pump. Brand new, made in America.

Ideal for pumping any liquid. Many uses on any farm.

£14/14/-

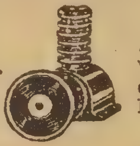


Will work off any 32-volt lighting plant.

BRAND NEW AIR COMPRESSOR

2.2 cubic feet, will pump up to 75lb.

Never before at this price. Ideal for Spraying.



£11/15/-

Will work off ¼hp Motor.

Another Lucky Repurchase!

American Elgin 8-day aircraft clocks.

FIT ONE TO YOUR CAR OR TRUCK.

£5/5/-

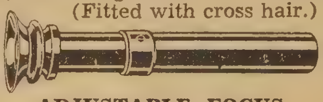
The name of Elgin is world renowned and made by the best manufacturer in America.

ARMY FOCUSING TELESCOPE.

Easily converted for use on dumpy levels.

Can be used as a rifle sight. Excellent magnification .. **£4/19/6.**

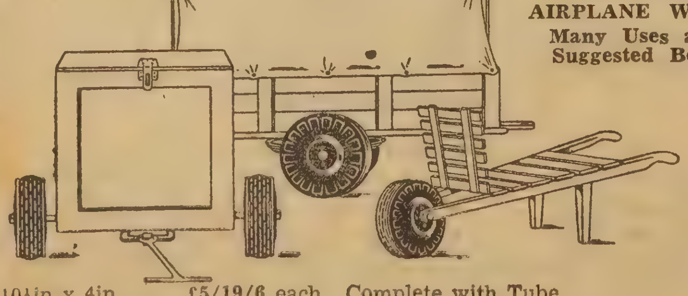
(Fitted with cross hair.)



ADJUSTABLE FOCUS.

BRAND NEW AIRPLANE WHEELS

Many Uses as Suggested Below.



10½in x 4in .. .. £5/19/6 each. Complete with Tube.
12½in x 4½in .. .. .. £6/17/6 each. Complete with Tube.
12½in x 4½in, ball-bearing hub, £7/15/-. Complete with Tube.

SURPLUS

512 Elizabeth St., Melbourne, C.I.
Phone: FJ5904. Just 4 do
Mail Orders Carefully Pack
Please Add Freight or Postage

SPECIAL OFFERS

NEW DEPARTMENT SPECIAI
All wool Army blankets, 37/
Heavy duty Army boots, 39/6 p
Jungle green herringbone sel supporting trousers ... 39/6 p
Army jungle green shirts, 23/
Khaki short-sleeve shirts, 19/
Khaki berets, leather bound, 8/
Water bottles, complete wi carrier 4/
Canvas and leather rifle case 15/-.
Best quality bib and brace ove alls, navy or khaki . 29/11 p
Boiler suits, navy or khaki, 52 pr.
Army slouch hats, all sizes, 22/
Fleecy-lined gloves .. .. 6/6 p
American type G.I. Caps .. 7/
Yachtsmen's slickers, guarante waterproof 75/
Leather Safari jackets, £7/17/
Leather lumber jackets, £5/19/
American gaiters .. .. 3/6 p
Australian gaiters .. .. 5/6 p
All wool khaki socks .. 7/6 p
Fur-lined leather gauntl gloves .. .. 42/6 p
Motor-cyclists' waterproof suit Coats, £4/15/; Trousers, £3/3/

Complete Hydraulic Set compris new 1000lb hydraulic pump, ho ing valve, reversing valve, hydr lic reservoir, hydraulic ram, r thrust 11in with complete diagr for assembling. Cost £150. Whitworth Spanner Sets open end, ring the other, **25/-** set. 6 sp ners to a set. English Hair Cl pers, first-grade quality, **17/6** SAE Open End Spanners, 6 to **24/6.** Whitworth, 4 to set, 1 Office or workshop necessity cl and date stamp combined, worth our price **59/6.** 2½in Paint Brus set in rubber, special price, 1 Brand new ⅜in Spark Plugs, most old type cars, **2/6** ea Brand new RAAF Life Jack kapok filled, **27/6.** American m.m. Movie Cameras, take stand film, **£12/12/-.**

WATCHMAKERS AND INSTRUM MAKERS

English Tweezers .. .. 6/6 and
English Pin Vises .. ..
Eyeglasses .. .. 6/6 and
Extra strong double lens Eyeglass,

STORES

512 Elizabeth St., Melbourne, C.I.
from Victoria Street. Phone FJ5904
and Efficiently Despatched
Include State in Address

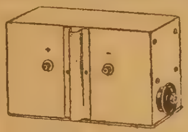
RAF Leather Flying Helmets, 35/-. Speaking Tubes, 50/-. RAF MK8 Goggles, 48/6. MK7, 37/6. Flying Boots, wool lined, £5/19/6 pair. Stock and Die sets, ½in, ¾in and 1in water pipe, £5/10/-. English double-ended spindle ¼ h.p. 230 volt motors, capacitor start, worth £18/18/-, £12/12/-. Canvas Tool Rolls. Ideal for the car, 8/6.

SPECIAL OFFERS

Generator Test Meters 35-0-35 amp meters 4½in dial 45/-, 0-10 volt meters 4½in dial 45/-. Loading Resistors can be supplied to make volt meter read 10-20 at 12/6 extra.

Swiss Music Box Units can be fitted into any type of box. Make yourself a music box. Tunes available: Whistle While You Work; Home, Sweet, Home; Happy Birthday To You; Little Brown Jug; Road To Gundagai, 30/-. Medical scalpels, many uses, photographers, etc., 6/6. Twist Drill Sets, 1/16in to 3/16in, 9 drills for 6/9; 1/16in to 7/32in, 7 drills for 6/9. Shaded Pole Induction Motors, made by Hoover of England, 230 volts, AC. Ideal for Projectors, Tape Recorders, Fans, etc., £4/19/6. Ball and Socket Inspection Mirrors. Ideal for Mechanics, 8/6. Tapped Transformers, 6, 12, 18 and 24 volts, 3 amps, 39/6. 230 volts input. Low Pressure Spray Guns, £3/15/-. American Feeler Gauges, 8/6. Army Steel Tow Ropes with looped ends, 17/6. Army Tripods. Many uses for photographic work, levels, etc., 41in long, 22/6 each. Tailors' Shears, 8in, 15/-; 9in, 17/6; 10in, 22/6; 11in, 27/6; 12in, 33/6; 13in, 37/6. 4in Calipers, inside and outside, 5/6. Parabolic Reflector Mirrors, 3½in, 15/-; 10½in, 39/6. Build yourself a spotlight or for photographic work.

COMPLETE BATTERY CHARGER



Fitted with brand new English Selenium Rectifier.

Works off 230v. AC Household Supply.

Charges any battery from 2 to 6 volts at 4 amps. £6/15/-, complete.
Also available, 6 or 12 volt Chargers, £7/15/-.

Battery Charging Generators. Ideal for Home Lighting Plants.

2-volt 500 watt, in Good Working Order	£5
2-volt, 500-watt, new	£7/10/-
4-volt, 1000-watt. Brand New,	£12/10/-

SPECIAL DISPOSALS METER OFFER

MILLIAMPERES

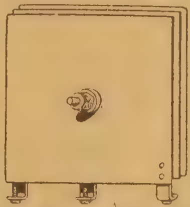
0-10 amp meters, AC-DC, 2½in dial .. 45/-
0-1 milliamp, 2½in dial 37/6
Weston 0-50 volt 0-100 amps combined M/coil, £3/10/-

English 50-0-50 Ammeters M/coil	37/6
English 20-0-20 Ammeters M/coil	37/6
English 0-20 Voltmeters M/coil	25/-
English 0-300 AC-DC Voltmeters	55/-
English 0-5 Milliammeters, 2¼in.	27/6
English 0-150 Milliammeters, 2¼in	30/-
English 0-25 Ampmeters, 2½in, M/c	30/-
English 0-10 Ammeters, 2¼in Dial Moving Coil	45/-
English 0-30 Voltmeters, 2½in Dial AC-DC	42/-
Eng. 0-40 Ammeters, 2¼ Dial AC-DC	42/-
English 0-50 Ammeters, AC-DC	42/-
Eng. 0-3 Ammeters 2¼in Dial AC-DC	45/-
Eng. 0-5 Ammeters 2¼in Dial AC-DC	45/-
Eng. 0-150 Voltmeter, 3in Dial, Moving Coil	39/6
Eng. 0-500 Micro Ammeter M/coil	37/6
Eng. 0-150 Ammeters, 3½in Dial, AC-DC	84/-
Eng. 0-50 volts 3½in Dial, AC-DC	75/-
Eng. 0-20 amps 2in Dial M/c	25/-
Eng. 0-1½ Milliamps 2in Dial M/c	19/6
Eng. 0-20 Milliamps 2¾in Dial AC-DC	17/6

BRAND NEW ENGLISH RECTIFIERS

Make yourself a Battery Charger.

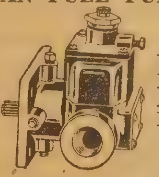
12v.	2 amp,	35/-
6v.	5 amp,	50/-
12v.	5 amp,	79/6
12v.	3 amp,	45/-
6v.	2 amp,	24/6
6v.	4 amp,	45/-



Transformers to suit above Rectifiers, 2 amp, 37/6; 6 volt 5 amp, 45/-; 12 volt 5 amp, 45/-.

AMERICAN FUEL PUMPS

USED BY THE R.A.F. STAINLESS STEEL VANES



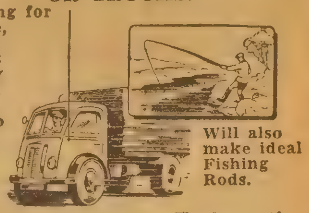
WILL PUMP ANY LIQUID

400 gals. per hour. In excellent order, 55/-. Brand new, 75/-.

STEEL ARMY TANK AERIAL RODS WILL MAKE IDEAL RADIO AERIALS FOR CAR OR TRUCKS.

Too long for postage, advise nearest railway station.

Base to suit Aerial, 9/6 EACH.



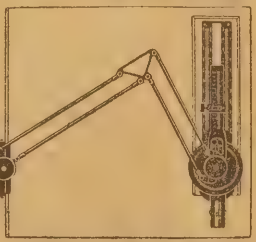
Will also make ideal Fishing Rods.

12ft long, 3 sections. Each section 4ft, 22/6. 8ft long, 2 section, 15/-.

Replace those broken side curtains with cellulose acetate which takes the place of celluloid and lasts four times longer. Will not discolor, 32/6 sheet.

Non-inflammable acetate sheet is recommended for all types of side curtain. Sheets are 1.20 thousandths thick. Size of sheet, 24in x 52in. Can be sewn or cemented into frames.

R.A.F. PLOTTING BOARD WITH ARM



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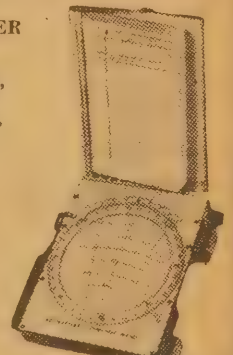

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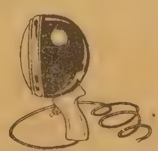

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OFF THE RECORD — NEWS & REVIEWS

The impact of microgroove on the release of serious music is now profound. It also forms an interesting comment on the relative popularity of many standard works, at least if we can take as a guide the frequency with which they appear in the catalogues.

ACCORDING to a correspondent, one such American catalogue, dated February this year, lists 13 versions of Beethoven's Emperor, 13 of the Fifth Symphony, 12 of the Sixth, nine of the Violin Concerto, and eight of the Ninth.

Brahms' No. 1, with 12 versions, is his most popular work, followed by nine of the Second, eight of the Haydn Variations and seven of the Violin Concerto.

Dvorak is represented by 10 recordings of the Fifth, and Mendelssohn with 11 of the Violin Concerto.

Gershwin, always popular in America, has 11 American in Paris, and 10 Rhapsody in Blue.

HAYDN POPULAR

Possibly the most astonishing list is credited to Haydn. There are over 100 different recordings of his symphonies, representing 65 works. The Surprise has been recorded 12 times, the Clock nine times, and the Drum-roll six.

Mozart has 49 different concertos, several for the piano available in up to six versions, and 31 symphonies, including 10 Jupiters and nine Haffners. There are 15 different performances of Eine Kleine.

Schubert has 13 versions of the Unfinished, Schumann 12 of the Carnaval suite.

As might be expected, Tchaikovsky scores heavily. The Nutcracker appears 17 times and the Romeo and Juliet Overture 16 times. There are 14 of the Sixth Symphony, 12 of the Fifth, and 11 of the Fourth. The Piano Concerto is found 13 times.

Bach has 185 different works, well spaced out, with 42 cantatas.

In the popular field there are also some high scorers, 10 of them South Pacific. Bing Crosby has 41 LP's, Kostelanetz 22, Benny Goodman 17 and Morton Gould 15.

Of great value to the student is a recording of the Trout Quintet, recorded five times, each time with one instrument missing. The student plays this one himself. This idea has been done in the past, but the LP gives it a new twist.

Whether this colossal repetition is in the interests of all is hard to say. It could be that a selection of half-a-dozen perfect recordings would be better than 17 not so good. But it does clearly indicate the expansion there has been in the recording field. It should not be hard to find 200 companies in USA now making records, on a fairly wide scale.

Westminster, who have claimed from the start their special attention to technique, are talking about a new recording method, of which samples are now on sale in America. Maybe we'll see some of these pressed here before long.

LONG PLAY 45's

The Long Play 45 7-inch discs seem to have caused some confusion in USA, with a playing time of about 8min. These are ideal for including many works which previously called for a 12-inch double-side 78, such as the many popular overtures. It could be that this type of record will replace the shorter playing 45 discs, which were limited to about 5min 20sec. They could undoubtedly cut down the need to turn over many of the original 45's.

I have been able to hear some further issues from EMI, including a batch of HMV Long Play records. These are put out in a most attractive type of cover in four colors, featuring the well-known dog picture. Here are some of my impressions of them:

TCHAIKOVSKY: Music from th ballet Sleeping Beauty. Played b Leopold Stokowski and his Symphon Orchestra. HMV ALP1002.

This record is a happy combination of everything that goes to mak a good record—fine playing, universally loved music, and impressiv recording.

Tchaikovsky is probably as well known for his ballet music as fo anything else—it is probably tru to say that for every one who know the Pathetique Symphony there ar four who know the Swan Lake an at least parts of the Sleeping Beaut

This popularity is well deserve for ballet is a field in which th composer excelled. Even if the listener has never seen the ballet—an this will apply to most—there is littl difficulty in enjoying the contrastin sections, or, for that matter, in supplying one's own mental choreography. I doubt whether anyone ha not become familiar with some of in his every-day listening.

The recording is really excellen It isn't brilliant in the way tha Decca's La Boutique is brilliant, an of course the music has much les jingling and top brass to make it s But it is full-bodied and balance and wide enough in range to b most satisfying. Apart from a fe crackles at the commencement of th sides, probably because the record used was a used sample, the surfac is extremely quiet, and has barel noticeable deterioration at the centr The performance matches the recording.

I feel sure this will prove one o HMV's best sellers in microgrooves.

SUITE FOR ORCHESTRA

DOHNANYI: Suite for Orchestr Opus 19, played by the London Symphony Orchestra, conducted by Malcolm Sargent, Columbia 33S1001.

Dohnanyi—pianist-composer — i probably best known for Variation on a Nursery Theme. This suite isn' far removed in its general impression, although its four movement cover a wide field of romantic expression, the most important of whic are the six-variation first and th interesting rondo of the last. Although its date is 1911, it looks backward rather than forward into th "modern" era, and many will like the more for that. It is pleasant an bright, makes little demand on th mind, but has plenty of appeal t the ear.

The recordings seems a little remote in the top register, although th music itself seems to favor the middl scale. A few drum patches are clea and convincing. The surface seems t be very good, noise level for th most part being inaudible.

★ ★ ★

BRAHMS—Symphony No. 1 in minor, played by the NBC Symphon

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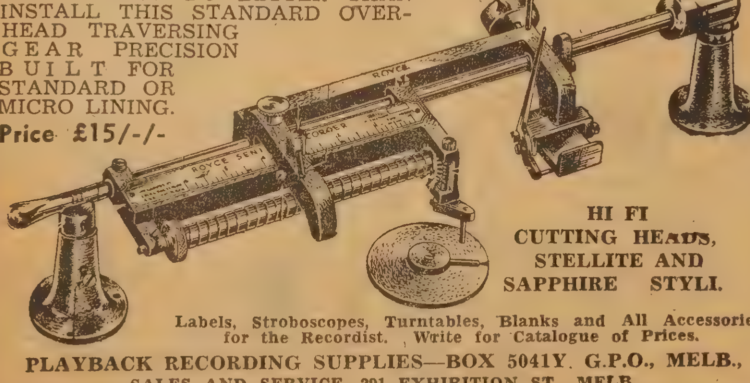

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Orchestra, conductor Toscanini. — HMV ALP 1012.

This recording will bring home to you the miraculous quality of Toscanini as no other record has done, if only because you simply cannot break a Toscanini movement once it has begun without doing intolerable vio-ence to a work of art. With 78 reords, this couldn't be helped — now ou will be able to hear his work without a break.

No other conductor is able not only o command the shape of music in his wn mind, but to impose it to perfecon on his orchestra. Not for an intant can you find a spot where he is ot the absolute master of them all. Nor can you believe, as the music ows by, that he has lost the signifiance of a single note, or has failed to lace in its exact proportion every ar and every phrase. In fact, it will e surprising if you do not hear inruments and interplay of instruents which, in other recordings, ave just not been there.

DYNAMIC RANGE

One reason for the terrific impact of this music is the greatly extended ynamic range made possible by microgroove.

Toscanini is a completely uncomromising musician, and in the past the recording engineer has had to do the best he could, even to cutting a hrase to pieces to arrange a record reak. But not here. The last movement, particularly, is a thrilling exmple of how musical mountains are uilt to stand out in full stature gainst their quieter foothills. You'll eed no convincing of the magnifience of Brahms after playing this ecord.

I know, of course, that there are any who don't like Toscanini—the rill sergeant, as someone once calld him. That's a matter of opinion, nd I would agree that occasionally ere is a brusqueness which might ell have been softened with advange.

The recording might sound a little ugh on wide-range machines, but erfectly OK on the average. There just about the right amount of reerberation — certainly we do not ve to suffer that horrible dead udio effect, which has ruined other oscanini records. The scoring of this mphony is extremely heavy, but e recordists have resisted the temption to spoil cohesion by trying to ck too much out of it.

This is a thrilling performance hich you should hear at the first portunity.

GOLETTO

VERDI — RIGOLETTO, with Jan erce (Duke), Leonard Warren igoletto), Erna Berger (Gilda), CO-Victor Orchestra, under Renato llini—HMV ALP 1004-6.

Fine though this performance is, it derlines the big danger in recorded era on which someone will have to ke a decision. Assemble a clutch good singers and a good orchestra fore a microphone, and you will get clearly-recorded performance of a itten score, and little else. There little sense of the movment of ama in these records, with the posle exception of the last side, when climax is handled with much re animation, sound-effects and all. Personally, I would sooner lose nething in presence and gain the ge atmosphere of the Wagnerian records made at Bayreuth. We have some undeniably fine voices which are frequently used with great effect, but three hours listening to them singing invariably from the same spot cannot help but create a kind of mental daze before the end is reached.

Of the singers, Jan Peerce is untiring, but not nearly light enough. He sounds more likely to defend Gilda's virtue than to assail it. And Erna Berger isn't quite fluffy enough to fall for the Duke's line, and far too robust in the final duet for a girl who has been through quite an ordeal, even before being stabbed and wrapped up in a sack. I know these things should be overlooked in opera, but I'm too much of a realist to pass them by.

Against all those personal reactions, I must place a magnificent recording, and a consistent one, with very little drop in quality at the record centres. Balance between orchestra and vocalists is all one could desire, and the orchestra itself is all it should be. Being the first full-length recording of the opera I have heard gives it a special impact, but on the whole I think it will be a hard one to beat for some time to come.

As a final word, the records have given the opera four Acts by splitting up the first, despite the fact that the annotations preserve the original three. It tricked me for a few minutes, and I'm sure it will puzzle quite a few.

MOZART SERENADE

MOZART — Serenade in E Flat, K375, played by the London Baroque Ensemble, conducted by Karl Haas. —Parlophone Odeon PMB 1002.

A beautiful piece of recording of charming Mozart written for wind instruments — two oboes, clarinets, bassoons and horns. The intimacy of the work is beautifully preserved and everyone will like it. The surface is excellent.

The Australian Diaphon Company which made the first Australian microgrooves, announce their tie-up with the French "Chant du Monde" Co., and have a number of releases lined up. These include Rachmaninov's Second Piano Concerto, and Shostakovitch's Song of the Forest for orchestra and 100 voices.

Also projected is a 78 release of the Eine Kleine Nachtmusick, by the Civic Symphony Orchestra, which was their first LP effort.

Nixa now have some further records available including a Brahms Violin Concerto, which has already sold well in England; two Haydn Concertos, for Trumpet and for horn, and the Mozart Post Horn Serenade. So far, I have not heard these records.

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SHORT-WAVE NOTES BY ART CUSHEN

RADIO JAPAN BEAMS SERVICES TO AUSTRALIA

Radio Japan, Tokio, the new International Service of the Broadcasting Corporation of Japan is to extend its overseas transmissions from five to ten daily transmissions within the next few months.

IN details just received from Tokio, Mr. Isamu Yamazaki, Chief of the International Broadcast Section, states the five new transmissions will be directed to Europe, Siam, Hawaii, South and Central America, and Australia. Insufficient funds compel the commencing of the Australia and Siam transmissions to be postponed until October.

The opening of the service to Australia will be the first service from Japan since the ending of World War II, up to that period the daily transmissions from Tokio were well received in this area.

The new services have not yet been scheduled to commence, but the latest Radio Japan schedule, listed below, gives details of the present five transmissions being broadcast for Tokio.

Transmission 1, to North America, 3.0-4.0 pm, JOA6 (15135), JOB4 (11705).

Transmission 2, to North China, 9.0-10.0 pm, JOA3 (9675), JOB2 (7180).

Transmission 3, to Central China, 10.0-11.0 pm, JOA3 (9675), JOB2 (7180).

Transmission 4, to Philippines-Indonesia, midnight-1.0 am, JOA3 (9675), JOB4 (11705).

Transmission 5, to India-Pakistan, 1.30-2.30 am, JOA3 (9675), JOB4 (11705).

In each case English news is presented two minutes after the opening of the transmission, while news in Japanese is broadcast 37 minutes after the broadcast commences.

COMMERCIAL SERVICE OF RADIO GOA

Verification of the form of program booklets from the Commercial Service of Radio Goa, PO Box 90, Goa, Portuguese India, lists the station's schedule as 1.30 pm-4.30 am, and the frequencies used are 3425, 6025, 9610kcs. The station broadcasts many English commercial programs, directed to listeners in Inda, and also carries broadcasts in Portuguese, Hindi, Concani, Marathi, Urdu, Guyarathi, and Sindhi.

Radio Goa was first on the air on May 28, 1946, when experimental broadcasts were conducted by the local Post and Telegraph Department, which was the beginning of the Goa Radio Club, which today operates the Commercial Service. Proof of the popularity of the station, together with Radio Ceylon, are shown by the fact that radio licences have increased from 400,000 in October, 1949, to 518,000 in October, 1950, and much credit for this rapid progress of radio in India, must go to these two stations.

41 METRE BAND USED BY AMATEURS

The use of the commercial section of the 41 metre band, from 7200 to 7300 kilocycles, by USA amateurs, came into effect in February, and this has made a very noticeable effect on reception of regular short-wave stations using the band. Interference is at times severe from these US stations, which are the high powered permit ones, which are using the higher frequency end, the complete band, 7000-7300kcs now being used by amateurs. This band, was for many years, used only by the amateur transmitter, but during the war years was taken over by the commercial broadcasters. It will be interesting to see if the commercial stations leave this band to its rightful owners. Most of the 41 metre band is being used by relay stations, with Voice of America programs, though some BBC, ABC and Japanese transmitters make regular use of the frequencies. The jamming, such a bad feature of the band, does little to make it a promising outlet for amateur stations, until such time as this type of interference is deleted by Moscow.

NOTES for the next issue close at 212 Earn Street, Invercargill, NZ on May 9th. All times are Australian Eastern Standard Time.

FROM THE MAILBA

Prize verification this month, is
200w Ecuadorian station, HC1BF, PO E
2587, Quito, Ecuador. MC1BF was he
with a late program on New Year's D
and the verification letter states the s
tion acknowledged our report over
air. The slogan is "Radio Commerci
and the station operates 9.0 pm-2.0
daily.

Switzerland: The International Co
mittee of the Red Cross, Geneva, c
firming reception of the special test
November, state that they have recei
many reports, and it may be some ti
before all are verified. Mr. George Kuh
head of the Broadcasting Section, infor
us that they will shortly carry out furt
tests, and will advise us in ample time
let readers know of the frequencies us
The Red Cross uses both transmitters,
frequencies, assigned to the Swiss Bro
casting Corporation, which would be lo
ed to the Red Cross for use in any em
gency.

Monaco: Radio Monte Carlo, Mon
now confirms reception with a bright c
which shows a photo of the antenna to
set against a mountainous background,
the country behind Monte Carlo. C
have now been assigned to the Mon
transmitters, and they are 3AM2 (14
3AM3 (60635), and 3AM4 (7349kcs).
station operates 4.0-6.30 pm, 9.0 pm
am.

Philippines: DYH4, Dumaguete C
Negros Oriental, Philippines, informs
that they now operate from 8.0 pm-1
pm, on 6055kcs, relaying DYSR (840k
News is presented daily, except Sunc
at 8.10 and 10 pm. The station is loca
at the Sillman University, and broadc
mainly missionary programs.

FLASHES FROM EVERYWHERE

NEW 100KW EGYPTIAN TRANSMITTERS

Two new 100kw short-wave transmitters are now operating from Cairo, with broadcasts in Arabic directed to the Middle East, according to Radio Australia. The transmissions are on 9752 and 6085kcs, from 2.0 to 5.30 am. These two new transmitters are to be increased by a further two in one month's time, and then the service will be extended. The 9752kcs outlet has been heard here to after 5.0 am, and again at 5.0 pm.

FORCES BROADCASTING SERVICE—SINGAPORE

A new Forces station, reported by Rex Gillett and Jim Paris of Adelaide, operates on 5010kcs, and from 10.0 pm to midnight. Programs are mainly in Hindustani, but English is used on opening and closing.

RADIO NEW ZEALAND
Latest Schedule

To Australia, 4.0-7.45 am, ZL7 (60
8.0 am-3.45 pm, XL3 (11780); 4.0 pm-
pm, ZL7 (6080).

To Pacific Islands, 4.0-7.45 am
(9620); 8.0 am-3.45 pm, ZL9, (11810); 4.0
8.45 pm, ZL8 (9620).

Sign off is 8.45 pm on weekdays,
pm Saturday, 8.0 pm Sunday.

BBC USES NEW 25M OUTLET

Following a test in early March
your correspondent, the BBC are
using a new 25 metre band freque
11920kcs, which carries the General O
seas Service to South Asia from 1.1
4.15 am. This frequency, 11920kcs,
exchange for 11680kcs, with the British
The test, carried out from 5.0 to 6.45
found the frequency well received a
5.30 pm, up to this time Paris is also u
the channel in its overseas transmiss

BELGIAN CONGO

Due to the use of OTC as a relay sta
of ORU, Brussels, it is pleasing to re
reception of a direct broadcast from
poldville, which will be an easy log
readers. The station OTM, operating
9380 kilocycvles, has been heard at
pm with popular music, and at 4.0
following announcements, and identi
tion in French, news in French is pres
ed, news in Flemish follows at 4.10
and the station closes at 4.30 pm. In
mornings reception is also possible to
am on the same frequency, while
smaller 7500w transmitter OTH, ope
ing on 9210 kilocycles, signs off at 4.30

POLAND: Radio Warsaw's N
American service, using 9550 and 602
is being received at increasing stren
and soon should be received at
strength which we are so used to
winter. Warsaw's best transmission
reception, is the one from 3.30 to
pm, on the above frequencies.

DIGEST OF DX TIPS

Kcs.	Call and Location	Times Heard. (AEST)
5010	F.B.S. Singapore.	10.00 pm-midnight.
5995	Suva, Fiji.	10 am-noon, 3.30-8.00 pm. English news 7.00 am.
6070	Sofia, Bulgaria.	6.45-8.45 am. noon-1.45 pm, 4.00-10.45 pm
6130	VLT6, Port Moresby, NG.	(Sat. to 11 pm).
7349	3AM4, Monte Carlo.	Opens 4.00 pm in French.
9610	TIDCR, San Jose, C.R.	Sign off 2.55 pm.
9710	Rome, Italy.	English to USA to 1 pm.
9755	Paris, France.	Arabic, 5.30-6.45 am.
10050	Cairo, Egypt.	Arabic, 3.00-4.00 pm.
11850	TGNC, Guatemala City.	English 1.00-2.00 pm.
11945	Djakarta, Indonesia.	Opens 7.30 pm with March.
17890	HCJB, Quito, Ecuador.	English session to 8.30 am.

THE HAM BANDS WITH BILL MOORE

BRITISH FLOODS SHOW NEED FOR AMATEUR NET

Although the damage in February 1953 in England caused by floods and gales is reported to be more widespread than that resulting from any similar disaster since the 18th century, the possibility of a similar happening occurring, should ensure the establishment of an official net of amateur radio stations to assist with communications should the necessity arise.

NDOUBTEDLY a graphic story will unfold on the work of radio amateurs Great Britain and on the Continent, ing the coastal flooding and gales that ised so much damage in February. The as devastated were so widespread t it will be sometime before the full ts are gathered together for publica- n.

n the February issue of R. & H. it will noted, that the authorities in the British es considered that the formation of an ateur radio emergency organisation, on ilar lines to those existing in other intries, was unnecessary.

t was stated that the normal com- nication services could cope with any ergency likely to arise.

The events of February proved that h was not the case and to quote:

'Radio amateurs in these stricken areas, oring the terms of their licence, but ling sure that public opinion would sup- rt them, immediately placed their tions and their experience at the dis- sal of the authorities. In Lincolnshire for ample, when Humber radio station was t out of action by the floods, local ateurs maintained a continuous watch the shipping frequencies. How well ey did their job no one will know unless enterprising journalist has been able to ag out a story.

'Four times in a few hours Grimsby d Hull radio amateurs intercepted stress calls from ships at sea. Yet only few months ago they and we were ld "that the Postmaster-General is tisfied that the normal listening watch aintained by the stations of the mobile rvice, should be adequate in all ordin- y cases to ensure that any distress mes- ge is picked up and acted upon. "What, ay we ask is an ordinary case?

"To the average British amateur it ems incomprehensible that the Post fice can be so short sighted — so alous of its rights—as to spurn genuine fers of help!"

The above was written by John Clar- coats, G6CL, secretary of the RSGB, the height of the disaster.

Special requests were made by the BC asking British amateurs to co- erate with the Dutch Amateur Radio nergency Service by generally assisting d keeping their net frequencies clear.

The whole story of amateur radio work the UK, Belgium and Holland should early show that a fully organised nergency service in these areas would disaster render valuable service.

ORTH COAST CONVENTION

The fourth annual North Coast Conven- on of the WIA (NSW) was held at aster during excellent weather and a ery representative gathering of NSW nateurs assembled. Full co-operation as given by stations in other areas ring the contests and the organising mmittee under the chairmanship of ieff Rettalick, VK2X0 is to be congratu- ted on the success of the event.

Results of the various competitions are follows:-

Jerry Challender Memorial Trophy: t, Don Pollard, VK2ASW, 194 points; d, Peter Alexander, VK2PA, 155 points; d, Harold Wright, VK2AWH, 135 points

144MC Transmitter Search (First Event): t team comprising Peter Alexander, K2PA, and Noel Hanson, VK2AHH; 2nd, arold Whyte, VK2AHA; 3rd, Shorty ameron, VK2NX.

144MC Transmitter Search (second ent): 1st, Bill Eagling, VK2AEY; 2nd, am comprising Peter Alexander, VK2PA, d Noel Hanson, VK2AHH; 3rd, Ken reenhalgh, VK2KG.

Urunga Scramble: 1st, Ron Stuart, VK2ASJ, 40 contacts; 2nd, Harold Wright, VK2AWH, 39 contacts.

FCC DECISIONS

After three years of extensive activity in the regulatory field in amateur radio in the US, the FCC have given final judgment on most outstanding matters

As a result, some of the changes are quite sweeping and not in accord with the anticipated verdict. The first change made was the opening of the telephony allocations, 3800 to 4000 and 14200 to 14300 kc/s, to all classes of licencee except Technical and Novice. These segments had previously been used only by Class A licence holders. This same condition applies to the new 7MC telephony allocation 7200 to 7300 kc/s. A3, Narrow Band Frequency or Phase Moduation may be employed on these allocations.

An additional segment was granted Novice Class Licencees 7175-7200 kc/s; where the input is limited to 75 watts and operation restricted to CW. FI (Freq. shift keying) emissions are also permitted in all non telephony segments of the 3.5, 7 and 14 MC bands.

The method by which amateurs must identify their stations has been listed. Amateurs must announce their calls, the call signs of station or stations being worked (net identification will suffice):

1. At the beginning and end of each single transmission.

2. At the beginning and end of a series of transmissions when Overs are less than three minutes, or at least every 10 minutes (Break-in or Duplex).

Generally, identification is required every 10 minutes and must be given on either CW or Telephony.

Regulations were also gazetted covering radio teleprinter transmissions.

Of interest to amateurs is the decision of the FCC to abandon their proposed regulations covering restricted segments in each band for calling and answering CQ's (R. & H., Oct. 52). Extensive opposition to the scheme was displayed in the US and the practicability of the scheme questioned.

Two regulatory matters still to be finalised are firstly the matter of telephony allocations on the 21MC band. The FCC proposed two telephony allocations one at each end of the band 21,000 to 21,100 and 21,350 to 21,450 kc/s this would be not in line with accepted usage of the international HF bands. The ARRL have requested that the telephony allocation should follow the IARU proposal, 21,250 to 21,450 kc/s, which is in keeping with recognised planning.

The ARRL has also suggested a number of changes affecting the 50MC band. They are:-

1. Allow Novice operation with CW or Telephony in the sector 51 to 53 mc/s (experimental for one year).
2. Allow duplex operation 51 to 54 mc/s.

Latest report shows that American amateurs went into action on telephony on the 21MC band as from the beginning of April. The exact allocation is unknown at the moment. They generally were unhappy about the propagation conditions during the opening days. Only good DX signals emanated from VQ4RF and VQ4HJP.

American stations hope that the extensive regulatory review is nearing the end, more changes have been made in the last few years than in the history of the hobby.

IN GREAT BRITAIN

From February this year onward, British amateurs were permitted to use frequency modulation on the following bands:- 1715—2000 Kc/s, 3500—3635 Kc/s, 3685—3800 Kc/s, 7000—7300 Kc/s, 14000—14350 Kc/s, 21000—21450 Kc/s.

These new privileges have been obtained after prolonged negotiations between the RSGB and the GPO.

First year licencees will be allowed to use F1 and other licencees F1, F2, F3 subject to the following proviso:-

That the carrier frequency is at least 10 Kc/s within the limits of the frequency band in use, and that the maximum deviation of carrier frequency shall not exceed 2.5 Kc/s. The maximum effective modulating frequency shall be limited to 4 Kc/s, and the audio frequency input to the frequency modulator at any frequency higher than 4 Kc/s shall not be less than 26 DB below the maximum input at lower frequencies. (Cont. page 87.)

WIRELESS INSTITUTE ACTIVITIES

Around this time of the year most WIA sections elect officers for the next 12 months and the annual meeting of the Hunter Branch of the NSW Division was held in March.

Officers elected for the ensuing year are as follows: President John Clarke, VK2DZ, Vice-President Max Sobels, VK2OT, Secretary Varley Fitton, VK2SF, Treasurer Bill Hall, VK2XT, Branch Correspondent Les Sparke of Kahibah.

A motion was carried congratulating the retiring President Lionel Swain, VK2CS, on his work since the inauguration of the branch.

Ron Stuart, VK2ASJ, retired from the position of Zone correspondent after doing excellent work in the past two years.

After the completion of the formal business the local VHF gang gave a working demonstration of operation on those frequencies. Participating were VK2OT, VK2AHA, VK2AGY and VK2ADS.

The annual meeting of the UHF section of the NSW Division of the WIA was held at Science House, Sydney on April 1st. The election of officers resulted as follows: President Bob Winch, VK20A, Vice President Bert Beresford, VK2ABB, Secretary Harry Solomons, VK2AJZ, Executive officers Roy Hart, VK2HO, Harry Lapthorne, VK2HL, and retiring President John Miller, VK2ANF.

Country visitor to the meeting was John Meagher, VK2AMV of Forbes. A film display was arranged for the remainder of the evening.

A VHF scramble was conducted by the section on March 29th. 27 stations participated operating on both 144 and 50 Mc/s.

The Federal Executive for the year 1953-54 comprises the following officers: Federal President G. Glover, VK3AG, Federal Vice-President W. Gronow, VK3WG, Federal Secretary G. M. Hull, VK3ZS, Federal Treasurer G. A. C. Ewin, VK3AGC, Federal Publicity officer H. Kinnear, VK3KN.

Co-opted for special duties are Assistant Federal Secretary J. Oxley, VK3AKO, Federal DX CC Manager G. I. Morris, VK3BZ, Federal Traffic Manager D. Paine, VK3FH, and Federal QSL officer R. Jones, VK3RJ.

NEW — SPEAKERS — AT — HALF — PRICE

Special purchase of 1000 new Permagnetic speakers made by one of Australia's leading manufacturers enables us to sell these units at half price.

8in SPEAKERS

HEAVY-DUTY PERMAGNETIC WITH 20,000 OHM C.T. TRANSFORMER .. **34/-**

6in SPEAKERS

HEAVY-DUTY PERMAGNETIC WITH 15,000 OHM TRANSFORMER **29/-**

POSTAGE and PACKING

	NSW	Interstate
12in SPEAKERS	7/6	12/6
8in SPEAKERS	5/6	9/6
6in SPEAKERS	5/-	8/6
TRANSFORMERS	1/6	

12in SPEAKERS

HEAVY-DUTY PERMAGNETIC WITH 5000 OR 10,000 C.T. TRANSFORMER **54/-**

WITH 15,000 OR 20,000 TRANSFORMER 50/-

Separate Transformers to suit any of above speakers—5000 or 7000 ohm 8/6 each. (Supplied with speakers only).

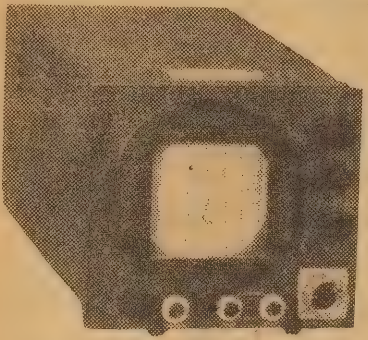
—NEW—RECORD—CHANGER—CLEARANCE—

WORLD-FAMOUS ENGLISH H.M.V. CHANGERS. Fitted with high fidelity lightweight pick-up and matching transformer plays 9in, 10in or 12in records.

Finished in Brown brocade. Freight extra. **£8/15/-**

"PAILLARD" CHANGERS. Made in Switzerland these changers are fitted with a variable speed motor, and high fidelity crystal pick-up with sapphire needle. Plays 8in, 10in or 12in records.

Freight extra. **£8/15/-**



New American indicator units. Complete with 8 valves 5BPI (with MU-metal shield) 4 6AC7 and 3 6H6 Ideal for that Oscilloscope.

£9/17/6

Plus Freight

NEW ELECTROLYTIC CONDENSERS

8 MFD-525v **3/6** each or **34/-** dozen plus post.
8 MFD-350v **2/6** each or **24/-** dozen plus post.
16 MFD-350v **3/-** each or **30/-** plus postage.

PAPER CONDENSERS

.1-400 volt **3/9** dozen plus postage.
.05-200 volt **3/6** dozen plus postage.
Mixed Mica Condensers __ __ __ **3/9** dozen.

Carbon Resistors

Well-known make of carbon resistors in values of 100 ohms to 250,000 ohms. In 1-watt ½-watt and 1-3 watt. All resistors are standard color coded and in original cartons. In lots of 100 mixed values comprising 50 1-watt, 25 ½-watt, 25 1/3-watt. Post free. **12/6**

IN LOTS OF 500, 50/-.

SOLDER

English resin multi-cored solder in 1lb reels, 10/9 per lb.
POSTAGE EXTRA

Standard Crystal Holders (new)

4 £1/-/- or £2/10/- per doz. (pins ¾in centres)

TRICKLE-CHARGER KITS

Kits for trickle charger as described in R & H, June issue. Comprising transformer with 18V winding tapped at 12V—3 100Ma rectifiers and 50 ohm control.

39/6 Postage: NSW., 5/-; Interstate, 7/6.

NEW VALVES IN CARTONS

SPECIALS

AV11 9/9
1K7G 8/6
1M5G 8/6
6K7G 8/6
6X5GT 7/6
VR65A 3/6

special price for quantity.

This valve is the English equivalent of the EF50 with 4vfil, and English octal base. Please add postage on valves.

6C4	15/
6AG5	15/-
EL33	12/6
1S5	15/
1T4	15/
1P5	12/6
1Q5GT	12/6
5Z3	15/
1K5	7/6
6K8	12/6
6SH7	7/6
EA50	7/6
7193	5/-
EF50 kith socket	11/6
6SH7 OR 1K5 ..	5/-

In dozen lots.

NEW VALVE SOCKETS

Teletron 8 pin octal moulded sockets **5/-** per dozen or **25/-** per 100.

American 8 pin loctal high insulation **5/-** per dozen or **25/-** per 100.
POSTAGE EXTRA

A.W.A. VIBRATORS

A.W.A. 6 volt gas-filled vibrators. Synchronous, Heavy Duty. New **15/-** each. Special price for quantity.

MIDGET GENEMOTORS

Input 28 volts at 1.1 amps Output; 250 volts at .06 amps. Size; 4½ x 2¾. Weighs only 3 1-8 lb. Perfect for use with 32 volt domestic receivers. Input filter free with each unit. Used but in good condition. **27/6**

New in carton **32/6**

Postage N.S.W. 4/-, Int. 6/6.

METROPOLITAN RADIO SUPPLIES

479 Parramatta Road, Leichhardt, N.S.W.
(At top of Taverner's Hill)

)X CONTESTS

Considering current propagation conditions DX contests are still receiving ir support.

The ARRL DX and BERU contests were in in March and April. The CW section the W/VE afforded some interest, but ie 28 and 21 mc bands did not produce any signals. 14 and 7 mc bands were ily fair, but did not prevent a good umber of VK stations from tallying o to 300 contacts.

According to the Americans 3.5 mc/s rovided most interest with prefixes such s TA3, OQ5, 4X4, ZS, ZS3, and ZK1 nd 2 appearing. According to Bill eonard, W2SKE, on V of A Bc/s outanding VK stations on the East Coast n 3.5 mc/s were VK2ADE, VK3ZC, VK3FH nd VK5KO. Two ionospheric disturbnces occurred during the contest and id not improve the scoring.

Entrants in the 16th BERU 1953 contest uffered too from poor conditions and ntrants had to work hard to tally reeectable scores. It is regretted that the st of prefix zones published in these otes covered the previous year's conest. A number of changes were made in ne zones for this year's contest.

)X AND PERSONAL

Jim ex VK3ADV is quite active as 'E7ADV and is anxious to contact his ld friends — generally operates around 015 kc/s at 1900 to 2000 hrs EAST.

ZC5VS is also keen to contract VK tations and will be active each Sunday nd Monday morning at 0030 hrs EAST on he low end of 7 mc/s. His QTH Box 36, Sandakan, Br. North Borneo.

For many years now Allen Appleby, 'K2BF, has been conducting the AOCP lasses for the NSW Division of the WIA. Many new amateurs whom Allen had rained will be sorry to learn that he has een forced to retire from the position. ack Fisher, VK2AAF, is the new class upervisor and continues the good work t the new class rooms at the Railway nstitute.

Feature of the RSGB's Radio Exhibition vas the demonstration of amateur Television arranged by the British Amateur Television Club. The demonstration was estricted to some degree as the conrol cabinet of George Short was destroyed while being transported to the exhibition. A total of over 50 valves and six months' work were lost in the accilent.

The following are the Argentine callsigns available to stations operating in the Falkland Islands and Antarctica.

South Orkney Islands:

Laurie Is. — LUIZA, 2ZA, 3ZA, 1ZG and 2ZG.

South Shetland Islands:

Deception Is. — LUIZC, 3ZI, 4ZI, 5ZI, 6ZI, 7ZI, 8ZI and 9ZI.

Palmer Island, Malaya, Archipelago, Observatory Island — LUIZB, 3ZH, 4ZH, 5ZH, 6ZH.

Argentine Continental Antartica, Grahamland, Margherite Bay: General San Marino Base, LUIZD, 1ZJ, 2ZJ.

Punta Proa — LU1ZE, 2ZE, 3ZE, 4ZE.

All the above stations are credits for WAZ and DXCC awards.

FEDERAL CONVENTION

The 1953 Federal Convention of the WIA was held in Melbourne during Easter when representatives from all State Divisions and members of the Federal Executive assembed to deliberate on the various proposals.

The Convention is the most important annual event in amateur affairs and delegates sat in conference for three days during the weekend. 19 agenda items and items of general business were discussed and Federal Policy was formulated.

During the ensuing year the Federal Executive will implement the dcisions made.

The following were the delegates from the various State Divisions: New South Wales, Jim Corbin, VK2YC. Victoria, Fred Bail, VK3YS. Queensland, Arthur Burton, VK4FE. South Australia, Jack Coulter, VK5JD. Western Australia, Ron Hugo, VK6KW. Tasmania, Bob O'May, VK70M. The Federal President George Glover, VK3AG, presided and all members of the Federal Executive were in attendance.

★ ★ ★

A new licence has been issued by the GPO in Great Britain for the use of the Boy Scout movement. The licence allows the establishment of a wireless transmitting and receiving station, to work not more than a given number of portable sets within a radius of 10 miles, and to exchange messages about the Scout movement. The idea is to allow Scouts experience in wireless telegraphy for training purposes. Messages may be sent only on one frequency within the band 144 to 146 Mc/s, subject to non-interference with government services. The permissible power input is 5 watts for one fixed station and 1 watt for portable stations. Radio telephony is only permitted on special occasions.

Frequency control and measurement requirements are the same as for amateur stations and a special frequency meter is required if the transmitter is not crystal-controlled. Secrecy, log-keeping conditions, are similar to those for G hams and the annual licence fee is 10/-.

YOUR OPPORTUNITY

to join the world-wide ranks of amateur transmitters! The Wireless Institute of Australia holds regular classes in Sydney to assist Sydney and suburban enthusiasts to obtain their Amateur Operators' Certificates of Proficiency.

Write for particulars to the Class Manager, W.I.A., Box 1734, G.P.O., Sydney.

Don't let a
ladder run
a little
BEAR
will fix it!
seals tighter!
mends better!
holds faster!
BEAR CELLULOSE TAPE

When you need instant aid, then you need a little "Bear Tape." Use it to instantly seal your parcels, and your lunch packets, double-seal your letters, mend children's toys. All so easily . . . at a finger touch!

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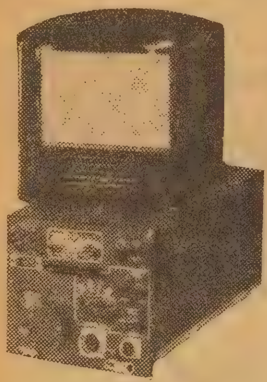
EVENINGS & WEEKENDS: "KALUA," COLLAROY ST., COLLAROY — XW5956



A.R.B. AMERICAN COMMUNICATION RECEIVERS

195KC to 9.025MEG Complete with Valves. **£19/10/-**

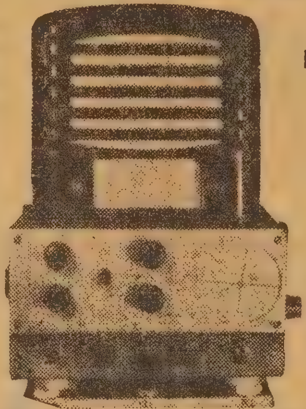
Converted, Air-tested. Complete with Power Supply and Speaker.

240V AC £29/17/6

24V DC **£27/17/6**
32V DC **£28/17/6**
12V DC **£32/17/6**
6V DC **£37/10/-**

Circuit Supplied with each Unit.

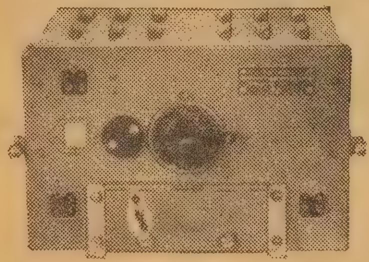
NEW BENDIX AMERICAN RADIO COMPASS RECEIVERS



Fully Converted for 240V AC.

Including Speaker etc., complete

29'17'6



500 NEW V.H.F. 14 VALVE TRANSMITTER RECEIVERS 150 TO 180 MEGS.

SUIT AMATEURS. VEHICLE BAND. EXPERIMENTERS.

All brand new. In original cartons including plugs and cables.

£4'17'6

SELENIUM H. DUTY RECTIFIERS

32V 5 AMP

£3/17/6

GENEMOTORS

Suitable for conversion to ¼HP A.C. Motor

£3/10/-

POWER TRANSFORMERS

240V. A.C. Potted Units sec. 260V. 250 M.A.

Also C.R.O. Transformers 1540 V

£2/5/- EACH UNIT

200 M.A. Chokes

Heavy Duty Potted Units

22/6

Selsyn Type Motors

Can be converted to 500 volt A.C. Condenser Start Motors.

Price each **£1/-/-**
Per pair **£1/15/-**

Ideally suited for Tape Recorder with suitable resistor or transformer.

NEW AWA HEAVY DUTY

GAS FILLED VIBRATORS

6 volt

15/-

AT5 TRANSMITTERS

Complete with Valves excellent condition.

£9/17/6

AT5 Aerial Coupler Units. New

£3/17/6

Used. Excellent condition

£2/2/-

CRYSTALS

1000 KC

English precision instrument crystals for that frequency meter or V.F.O. check.

£1/7/6

Postage 1/-

AWA

TELE RADIO

3BZ Transmitter Receiver Complete Stations AIR TESTED

Complete with Crystal to Required Frequency

£85/-/-

AR8 RECEIVERS

Complete with valves. Excellent condition.

£18/10/-

Converted to 240 V. A.C. Complete with Speaker Airtested **£28/17/6**

D or not 3D ?

(Continued from Page 7)

er companies will also adopt it
der various trade names.
n order to fill the wide screen (a
ture 25ft high by 64ft wide has
en suggested) without the need for
cial film or extensive changes to
isting equipment, use is made of a
ecial lens system which compresses
picture in a horizontal direction
that a wide angle may be accom-
dated on standard film. The image
the film is badly distorted but a
nilar lens system in the projec-
restores the wide angle to the
cture.

At the present time the true stereo
stem is being developed by Col-
nbia, MGM, Paramount, United Ar-
ts and Warner Bros., the latter
m, apparently, being keen to de-
lop both systems. As far as Aus-
alia is concerned, it seems that our
st taste of things to come will be
e screening of Bwana Devil, a
lor picture in true third dimension,
hich is about to be released by
nited Artists.

ANS INDEFINITE

At the time of writing, there do
t appear to be any definite plans
r the release of wide screen pic-
res, though it seems almost cer-
in that they will not be far behind
e true stereo systems.

Strangely enough, it appears that
e change over to true third-dimen-
onal pictures will be less costly than
at to the wide screen systems, even
ough an extra pair of projectors
ill be needed for the former.

Another important point about
e third-dimensional systems is that either of the two films used for third-dimensional projection may be released as a standard print suitable for existing projection systems. Thus the companies backing this system have very little to lose during the transition period or in the event of the scheme being dropped.

Films made for wide screen projection, on the other hand, are of absolutely no use to any theatre unless it is equipped to handle them. For this reason a general release of such films will have to wait until a large number of theatres are suitably equipped. This may give the third-dimensional systems something of a start over the wide screen systems.

ATTITUDE TO GLASSES?

But, from the motion picture industry's point of view, the "64-dollar question" at the present time is whether the general public will be sufficiently impressed by third-dimensional pictures to accept the inconvenience of having to wear special viewing glasses.

For the present at least these glasses will be supplied by the theatre, manufacturing techniques having now reached the stage where they can be made at a very low cost. (Between five and 10 cents in USA).

However, assuming that third dimension pictures become the order of the day, many theatregoers may eventually prefer to provide their own glasses, in frames to suit their own taste, and worn no more obtrusively than ordinary glasses.

At least one film company, Paramount, is at present considering the possibility of combining true third dimension with the wide screen made possible by the Cinemascope. This combination, plus color and a multi-channel sound system, should come very close to the ultimate in motion picture entertainment.

WIDE SCREEN ESSENTIAL

Having recently viewed some resurrected anaglyphs, our own impression is that they only serve to emphasise the present restricted screen area and that a wider screen is almost essential for full enjoyment of the third dimension.

The use of color in such systems does not present any technical difficulties and will probably continue to be used in much the same way as it is now, namely, for the more spectacular pictures which cannot be handled so effectively in black and white. While a useful addition to third dimension, it is no more essential than it is to a standard "flat" picture.

Assuming, therefore, that the public accepts viewing glasses, it seems almost certain that both the artistic requirements and the need for standardisation between the various companies will eventually force a combination of third dimension and the wide screen. If viewing glasses do not prove acceptable it seems almost equally certain that we can at least look forward to the wide screen becoming standard, forgetting 3D altogether for another decade, which brings us right back to where we started on the front cover—"Headlines on Hooey?"

APPOINTMENTS OF NOTE:

We are pleased to announce our appointment as exclusive Australian factory representatives for two well known overseas organisations:—

. PAINTON & CO. LTD., Northampton, England.

Manufacturers of electronic components to full interservice Standards specifications including:

1. Jones type plugs and sockets.
2. Attenuators and faders.
3. Rotary stud switches.
4. Continuously variable potentiometers.
5. Fixed and adjustable resistors.
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7. Miniature switches and heavy duty toggle switches.

"By appointment to the Professional Engineer."

. SOCIETA' PER AZIONI GELOSO, Milan, Italy.

Manufacturers of high quality radio accessories including microphones, crystal inserts and transmitting accessories for the Amateur and Professional engineer.

For example:-
Geloso Crystal Inserts:
Type M409. Frequency response 40-7000 cycles. Extremely robust and mechanically strong. Can withstand falls and knocks. No further casing is required as unit is complete as a microphone of attractive appearance. List Price, 32/11.

Geloso Crystal Microphones.
Type 400. A very attractive chrome plated "ball" type microphone of small physical size, complete with 3 yards of twin shielded low loss cable. Thoroughly shielded.
List Price, £5/19/11.

Geloso Transmitter VFO Unit M4/101:
and tested.
Bands: 3.5-4, 7-7.45, 14-14.4, 21-21.6, 28-29.8 megacycles.
Dial: Fully calibrated and band spread over 180 degrees.
Tubes: 6J5 oscillator, 6AU6 isolator, 6V6 output (not supplied).
Output: Tuned on each band, gviing at least 3.5 ma grid current to a single 807 on all bands.
Power Supplies (Not supplied with unit): 400 volts at
A very stable 5 band 3 tube VFO unit, fully wired
32-54m/a.
Price £10/4/9, including Sales Tax.

Type M410. Same unit as M409, but with extra screening to exclude RF pickup.
List Price, 38/6.

Tpye UN10. A complete crystal insert for incorporation in a cage in the manufacture of complete microphones. Used in microphones employed with Geloso wire recorders.
List Price, 30/7.

Type T30. Hand type microphone in well proportioned brown bakelite case. Unit stands on table without need for any stand. Uses UN10 fully screened insert. Complete with 4ft of twin screened low loss cable.
List Price, £3/12/-, Sales Tax included.

Manufacture and Wholesale Distribution enquiries invited from

R. H. CUNNINGHAM PTY. LTD.

118 WATTLETREE ROAD, ARMADALE, S.E.3.
CABLE "CUNNIG," MELBOURNE.
TELEPHONE UY6274.

MANUFACTURERS OF
COMMERCIAL RADIO
RECEIVERS FOR 14
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CLASSIC RADIO

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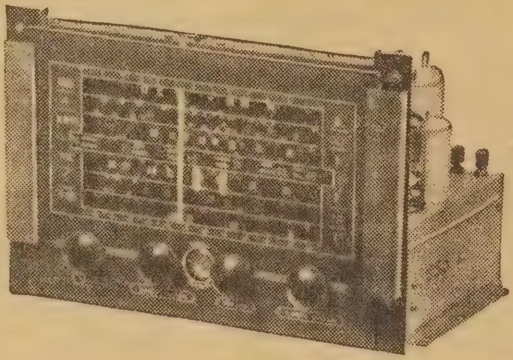
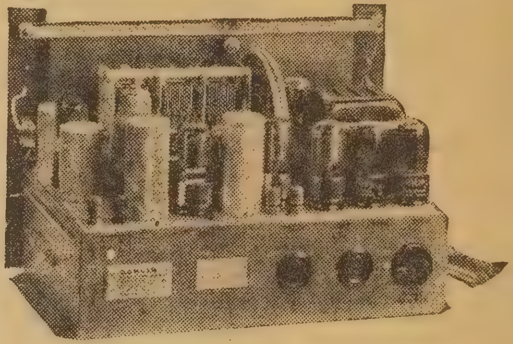
● ***World Range*** **£33/15/-** ***High Fidelity*** ●

9-Valve De-Luxe Dual-Wave Radiogram-Chassis

Including Magic-Eye Tuning Indicator With Matched Dual Speakers

FREIGHT EXTRA





COMPARE THESE FEATURES

- Ultra modern circuit with new high gain valves and permatuned iron cored coils and intermediates giving good interstate reception and a short wave range of 12,000 miles.
- High gain audio with push-pull output and tone control gives you high fidelity reproduction from both radio and your favorite recordings. Inverse feedback incorporated.
- Power switch is fitted to the tone control of all chasses thus enabling the power to be completely switched off from the set. Radiogram switch combined with wave change switch.
- Tuning is made simple and positive even on overseas stations by the use of a super sensitive magic eye tuning indicator.
- All chasses are wired for the fitting of an F.M. or television tuner or Tape Recorder. Special plug on back of chassis being provided, also standard 3-pin socket for power supply to motor.
- Speakers supplied are Magnavox 12in and 8in permanent magnet with tropic proof transformer. Single 12in supplied with 7 valve chassis.
- Large calibrated edge lit dial in plate glass (11in x 7in) with main stations in each State in prominent type, fitted with counterweight drive and indicator lights on dial showing which band in operation.
- Dial can be supplied in cream or brown with matching knobs and escutcheon to suit blonde or walnut cabinets.

ALL CHASSES CARRY SIX MONTHS' GUARANTEE.

A New 10 Valve Dual-Wave Radiogram Chassis

The ideal chassis for those difficult locations where reception is doubtful

Specifications as nine valve unit but with the addition of high gain tuned R.F. stage giving greater sensitivity and selectivity on both broadcast and short wave bands.

£38/15/-

7-VALVE WORLD-RANGE CHASSIS INCLUDING MAGIC-EYE

£27/15/-

SPECIFICATIONS AS NINE VALVE UNIT, BUT WITH SINGLE 6V6GT OUTPUT VALVE AND SINGLE 12" SPEAKER

FREIGHT EXTRA

Record Players and Changers

We have a complete range of 3 speed record playing equipment including B.S.R. or Garrard Players with turn-over crystal pick-ups or your choice of Garrard, Stromberg-Carlson, Collaro or the new B.S.R. 3 speed changer that will play 7, 10 or 12in records intermixed. All changes have turn-over Crystal pick-ups.

Large Variety of COMBINATION and CONSOLE CABINETS Available from £14

CLASSIC RADIO

245 Parramatta Rd.,
Haberfield, N.S.W.
Phone UA2145

AN EASILY BUILT HYGROSCOPE

A hygroscope, or damp detector, is sometimes very useful in a house for registering the humidity of the atmosphere, especially in a workshop, where there are steel tools liable to rust. This article, from an English contributor indicates how such an instrument can be built from oddment parts.

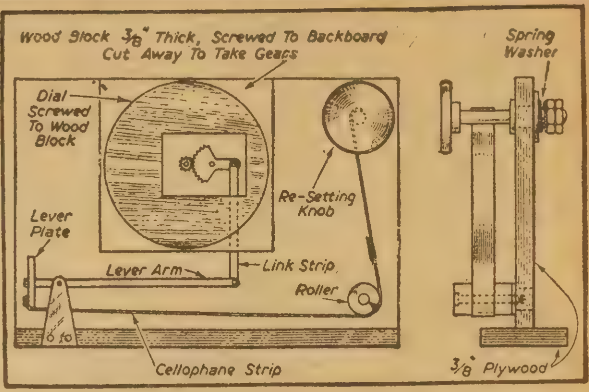

Wood Block 3/8" Thick, Screwed To Backboard Cut Away To Take Gears
Spring Washer
Dial Screwed To Wood Block
Re-Setting Knob
Lever Plate
Lever Arm
Link Strip
Roller
Cellophane Strip
3/8" Plywood

Fig. 1.—Front elevation (with dial removed) and side elevation of the completed hygroscope.

THE instrument described was made after many experiments in design and in testing various substances which would be sensitive to changes in humidity. The accompanying illustrations show the general layout.

A complete revolution of the pointer is registered when the instrument is moved from a living-room which is normally dry, to an upstairs room in which the atmosphere is more humid.

It would be a very simple matter to arrange electrical contacts on the dial and pointer so that when the humidity has reached a certain point, the electrical circuit is closed and a bell rings.

The material which actuates the instrument, consists of a strip of cellulose ½in wide, and the actual strip used was obtained from cellulose self-adhesive tape with the sticky substance removed with turps substitute.

The sensitivity of the instrument can be varied by altering the length of the cellulose strip, a longer strip being more sensitive than a short one.

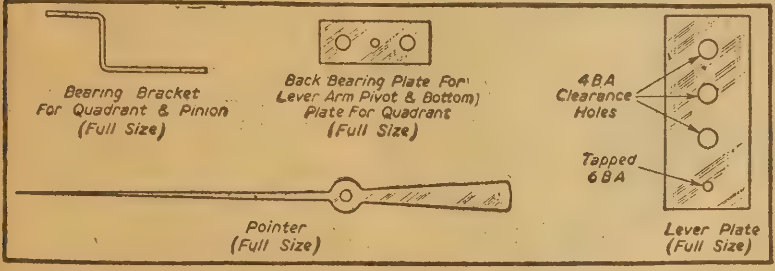

Bearing Bracket For Quadrant & Pinion (Full Size)
Back Bearing Plate For Lever Arm Pivot & Bottom) Plate For Quadrant (Full Size)
4BA Clearance Holes
Tapped 6BA
Pointer (Full Size)
Lever Plate (Full Size)

Fig. 2.—Details of bearing bracket, lever plate and pointer.

The alteration in length is obtained by fitting the re-setting spindle bush either in the top right corner of the back-board, or in the bottom right corner, the bushes for the re-setting spindle and for the roller being made the same diameter to make them easily interchangeable.

The sensitivity can also be varied by altering the length of the small lever plate which is secured to the left-hand end of the lever arm, the lever plate being drilled with three holes for this purpose. The cellulose strip is secured to the lever plate by a 6BA screw.

The lever arm is made from 3-16in diameter drawn brass rod 4¾in long overall, and the pivot, which is made from 5-64in diameter silver steel, is turned down to 1-16in diameter at each end and is fitted ½in from the left-hand end of the lever arm.

The link strip connecting the lever arm to the quadrant arm is made from 26 gauge hard phosphor bronze strip, and the end of the lever arm and of the quadrant arm are slotted to accommodate the link strip and drilled to take 22 gauge phosphor bronze pins which form the pivots.

The quadrant and pinion were obtained from an ex-disposals gearbox, the quadrant (cut from a brass gear-wheel 1in diameter) has 16 teeth, and the pinion which gears into it is 3-16in diameter and has 11 teeth.

The spindle of the quadrant and pinion are turned down at each end to 1-16in diameter.

The brackets and plates forming the bearings for the pivots of quadrant, pinion and lever arm are made from 22 gauge hard phosphor bronze strip.

The dial is made from ivorine, and is 4in in diameter, marked in divisions, and a stop is fitted to prevent more than a complete revolution of the pointer; stop-pins are also fitted to the back-board to prevent the quadrant from coming out of gear with the pinion.

The pointer is made from 26 gauge hard bronze strip, and is balanced; the central boss is a ½in diameter rivet drilled to suit the spindle of the pinion. (Fig. 2.)

The re-setting spindle is made from ½in diameter brass rod and is slotted to take the cellulose strip. The spindle is screwed at the back and fitted with a spring washer for easy turning. The re-setting arrangement was found useful as it enabled the pointer to be set at mid position, and variations in humidity registered easier.

The roller shown at the bottom right corner is made of ebonite ¼in diameter, and revolves on a brass axle screwed into a plugged bush of the same size as the bush for the re-setting spindle.

All parts must, of course, work very freely, especially the quadrant and pinion.

If the instrument is placed in an upstairs room and the pointer set as far as it will go clockwise, the pointer will fall to minimum or thereabouts when any steam is emanating from the downstairs kitchen, through washing clothes, cooking, &c.

When the atmosphere is humid, the cellulose strip softens and the weight of the lever arm stretches the cellulose and allows the arm to drop, thus causing the pointer to rotate anti-clockwise. When the atmosphere gets drier the cellulose strip contracts thus raising the lever arm and causing the pointer to rotate clockwise.

LET'S BUY AN ARGUMENT

(Continued from Page 75)

In taking response curves, particularly where any boosting is involved, it is absolutely essential to see first of all that the amplifier will not reach overload at any point in the range. With a CRO it is easy to determine this but, with no CRO available, the only alternative is to run through the frequencies with the speaker in circuit, noting how far the control can be advanced before the note becomes harsh and distorted.

The final frequency run, into a resistive load, is then taken with the control safely "inside" the limit position.

If you can make the meter read o db, at 1000 cps, it is far better to treat minus 5 or minus 6 db as zero reference, adding 5 or 6 db. to all the listed figures when you tranfer them to a graph.

The error involved at mid-settings of the volume control is far less than that incurred by an overload. In any case, it's the response you get from your amplifier under average listening conditions.

Looks like you'll have to take some more curves R.P. and don't be disappointed if they're not so impressive.

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Cross Talk between Layers	NONE	NONE

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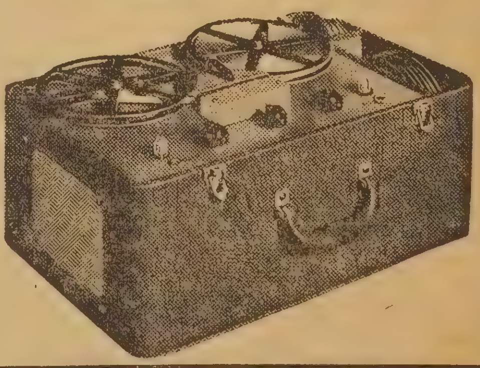

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THE R-J SPEAKER ENCLOSURE

(Continued from Page 19)

incipal requirement is that the ee-air cone resonance be relatively w, and the suspension is "soft" ough to provide a high compliance Fig. 4, a net internal volume of 00 cu. in. is provided, exclusive of e internal padding. It will be noted at the speaker board is spaced om the frontal board by such a stance as to reduce the peak caused the resonance of the enclosure so at the sound output is flat, essen- ally, from a frequency of 150 cps, t us say, down to 50 cps or less.

As previously mentioned, the spac- g between the speaker board and e frontal board determines the Q the enclosure, and effectively iminates the peak due to the Helm- oltz resonator effect.

The opening of the speaker board the same as the free cone area of e speaker used. The opening in the ontal board was shown to have an ea of 64 sq in.

If the enclosure is to be used as a oofer exclusively, a rectangular slot ould be perfectly satisfactory, and lequate performance would be obtained from the lowest frequency up 400 or 500 cps.

However, if the enclosure is to be sed for a wide-range speaker, then e frontal opening must be modified. hile the shape of the opening must e determined specifically for each ndividual cabinet type, it may be escribed roughly as resembling a skinny lemon."

It may be approximated by laying ut a diamond-shaped opening with s major axis about 25 degrees from e vertical and with its minor axis at n angle of approximately 15 deg. rom the horizontal.

The minor axis should be one-half e length of the major axis, and the total area should be the calculated 64 sq in.

Then, after the diamond shape is laid out, round off the obtuse corners, and extend the acute corners so that the "skinny lemon" shape is attained. Bear in mind that the low-frequency performance is a function of the enclosure volume and the area of the frontal board, and the high-frequency performance is a function of the shape of the frontal opening.

The spacing between the speaker board and the frontal board adjusts the Q so as to avoid a peak in sound output throughout the range from 50 to 100 cps.

From the foregoing, it is seen that the low-frequency performance is not as dependent upon the speaker as it is with some other types of housings. It is only important that the free-air cone resonance be relatively low — from 40 to 70 cps.

Since the object is to resonate the enclosure somewhat above the cone resonance, and since the volume and the size of the frontal opening determine the resonant frequency, it is readily possible to design a satisfactory cabinet for speakers smaller than the 12-in or 15-in models.

This has been shown by the performance of the 8in enclosure, which is 23½in long, 11in high, and 10in deep. The design of this cabinet is the same as for the larger one, being modified only by the differences in size and resonant frequencies.

From these comparisons, with a reflex baffle it may be concluded that, although it is based on a resonant principle, the R-J enclosure is a non-resonant system. The response with a 12in cone having a free-air resonance of 63 cps is smooth down to 50 cps, and has usable but attenuated output down to 30 cps.

It is also shown that the R-J provides air loading, which is instrumental in preventing frequency doubling and tripling, and maintains fundamental tones with a 12in speaker down to 30 cps. In addition, the R-J offers excellent speaker-damping, with the result that transient response is maintained.

LET'S ALL BE ANTHROPOLOGISTS

(Continued from Page 13)

ith its victim it will rise and re- urn to the vicinity from where was thrown.

In Mexico there persists an idea hich came down from early man any thousands of years ago. It onsists of a throwing board, with hich to increase the velocity of a hrown spear. It is really a device extend the length of the arm so at an increased initial velocity is btained. Sometimes this board is rovided with a string attached and ound round the spear in such a ay that when it is thrown it gives rotating action to the spear simi- ar to the action given to a bullet the rifling in a gun barrel.

In medicine, primitive man was dept at extracting healing essences nd juices from many plants, which e used to this day for the same rpose.

The examples I have given touch ly the fringe of the inventiveness primitive man. He used all the inciples which we use today and t along very well indeed, although rhaps a little more miserably. We, course, use the same principles a more "refined" manner, but I ten wonder whether it is getting very far. The most we can say that we can be miserable more mfortably.

TRANSISTORS

(Continued from Page 17)

- TV sets using batteries and transistors for most or all functions other than the picture tube.

Speaking at a recent function, Dr. Engstrom, of the RCA Laboratories, suggested that transistors have now reached the stage where engineers generally can begin to study their use. The manufacturers must concentrate on techniques which will allow them to be mass-produced at more reasonable cost.

He pointed out that the object of present research is to discover what transistors can do. They will inevitably displace tubes in many applications but, in many others, tubes might be preferred.

In fact, the transistor might permit the development of entirely new devices which will themselves require a certain complement of electron tubes.

In developing the various devices which were on display, RCA had used three point-contact and one p-n-p junction transistor which were due to be offered to American industry on a provisional research basis. In addition, the company had used six other junction transistors which were still in the developmental stage and aimed ultimately to exhibit better frequency and power handling characteristics. (See also technical article elsewhere in this issue.)

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ANSWERS TO CORRESPONDENTS

J.L.J. (Geelong, Vic.) sends up a completely new and radically different theory about the behavior of radio waves and asks us to comment on it and compare it with the more conventional explanation.

A. We may publish your letter later in order that other readers may be able to comment on your theory. In the meantime we can only point out that your explanation is not the conventional one, though that does not necessarily condemn it, and that your friend's explanation appears to be in line with accepted teaching.

B.K. (Lithgow, NSW) says he has been interested in the "Teach Yourself Radio" series and suggests that we should describe the construction of a cabinet to house the receiver.

A. Many thanks for your letter, B.K., and we are glad to note that the series has proved useful. We cannot promise to describe a cabinet but, with the information already published for the "New Minivox" and the "Holiday Set," you should not have too much difficulty in making something up yourself. By this time you will have seen the version of the set intended for portable use complete wtih a cabinet to match.

W.J.F. (West Ryde, NSW) says he is keen on transformer-coupled amplifiers and submits a circuit for possible use in the "Reader Built It" columns.

A. We agree that a good case can be made for the use of a high-quality transformer to feed triode output valves where such a transformer is available. However, the present trend is to use resistance coupling throughout and apply overall feed-back to minimise distortion in as many stages as possible. Nevertheless, we have put aside your circuit for possible use in the columns.

B.D. (Caulfield, Vic.) says he has been trying to talk through a microphone attached to a wireless but "it won't play."

A. You give no hint as to what type of microphone you have or how you are connecting it to the set. The only type likely to have enough output to be useful would be a carbon type, used in association with a battery and a suitable step-up transformer. The transformer secondary would be connected to the set's pickup terminals. Another point is that the microphone would have to be operated at some distance from the speaker, otherwise the sound waves between them would interact and lead only to squealing and howling effects. There is more to it than might appear on the surface.

J.H.H. (Ashbury, NSW) would like to build the simple portable described in the March issue but he is still in doubt about the idea of a loop aerial in view of the apparently conflicting information that a good aerial and earth system is important for a small battery set.

A. The pickup with a small loop is less than with a good aerial and earth of the conventional type but not so little as its small size would seem to indicate. You can expect good reception of all the local stations from within the metropolitan area with the loop alone. As mentioned in the article, an external aerial and earth can still be used if you wish to receive over longer distances. The earth wire is important bcause a battery set does not have power mains to act as a return circuit.

R.S. (Suva, Fiji) sends in a query for the "Answer Tom" page.

A. Many thanks and we will keep the query in mind.

A.R.T.T. (Wembly, W.A.) sends in the circuit of a simple shortwave converter designed to be used in conjunction with an ordinary broadcast band receiver.

A. Thanks indeed for your interest and the information. Although we can't promise to publish your circuit, we will keep it on file for possible use in the "Reader Built It" page of Radio and Hobbies at some later date.

M.K. (Callide, Qld.) writes to tell us that he has successfully completed his own version of the "All Wave Battery Three" using an alternative series of valves. He wonders if this will have an adverse effect on the performance.

A. The substitutions you have made should have no noticeable effect on the performance of the set and provided the valves are in good condition, there would be little point in buying new valves simply to conform with the exact specifications of the original circuit. If you wish to add an extra valve, it would be best to use it as an RF amplifier. The "IK5 Four" circuit should serve as a good guide to the requirements. The IF transformer you have will not be of much use but we can supply coil data for the set, covering the requireme of both broadcast and shortwave, throu the 2/- query service. Many thanks your suggestion regarding the publicati of a digest of circuits but the dema for new designs is so great that it doubtful if we would be able to spa the space.

B.B. (Benger, W.A.) is keen on crys sets and wonders where he can obta some information on the subject.

A. The September 1952 issue of Rad and Hobbies contained the descripti of an excellent crystal set. Full inform tion is given in the article and there little chance of you making a mista Complete books on radio, suitable beginners and specifying parts eas available in this country, are not good supply. However, a number books were mentioned in the "Tea Yourself Radio" article in the April, 19 issue. Possibly you will find our co ments of some assistance.

F.G. (East Minto, NSW) complains distortion and poor volume in a batte operated receiver. He finds that pe formance is better if he connects t lower end of the volume control the filament positive circuit rather th to earth as originally.

A. It would appear that the .02 m condenser between the IH5-G plate a the IQ5-GT grid is faulty. If you r place it with a new one and restore t volume control to its original connecti the receiver should operate normally. T explanation for the behavior of t set at present is that the positive bias the IH5-G grid causes it to draw mo plate current and thus the positive vo age appearing at its plate is less th normal. Therefore the positive bi applied to the IQ5-GT grid via the lea coupling condenser is less than it wou be with the 1H5-G operating under norm conditions. We must apologise for t delay in answering your other letter b a flood of queries plus staff holida have combined to make it impossible keep the letters up to date.

R.J.M.P. (South Yarra, Vic.) is havi trouble with instability in the "Pla master" Disc Recorder amplifier.

A. The fundamental problem in yo case is that the amplifier is unstab without feedback. The .0025 mfd co denser which is switched to bypass t screen of the 6AU6 to earth merely r moves the feedback at high frequenci The cure therefore is to treat t amplifier as you would any other u stable amplifier. Possibily the leads co necting the plate circuit of the 6V6-GT are close to the grid circuit of the 6A or the wiring to the level indicator met is too long. Some shielding at these poin may be indicated. Also check carefu the shielding in the grid circuit of t 6AU6. You could also try .05 meg sto ping resistors directly in the grid c cuits of the 6V6-GT's. The original a plifier was completely stable under conditions so that you can be fairly ce tain that your problem is due to som departure from the original layout.

J.Y. (Toowong, Q.) has a pair of hea phones which have nothing to indica whether they are high or low impedan types and wants to know whether the is any simple test by which this can determined.

A. The only way to get some indicati of the impedance is to measure the D resistance with an ohmmeter and if yo have no such instrument there is no eas way to check them. Probably the easie way would be to take them to your nea est radio serviceman who should be ab to check them for you in a few minute Alternatively you may be able to fin a friend who has the necessary equipme and who could help you out. The nomin impedance is generally a little high than the measured DC resistance.

T.K. (Kankesantharai, Ceylon) is anxio to build the multimeter described the "Learn While You Build" seri and wants to know where the parts ca be purchased.

A. Most of our advertisers, particular those specialising in kit sets, should

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Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

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To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three "R & H" constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis will now be 4/6. These are available for nearly all our designs but please note they do NOT show wiring details.

Address your letters to The Technical Editor, "RADIO and HOBBIES," Box 2728C, GPO, Sydney.

Note that "RADIO & HOBBIES" does not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.

e to supply you and we are passing
name and address on to one or two,
will doubtless contact you direct
the near future.

.P. **(Ballarat, Vic.)** wants to know
ether the set recently described in
"Teach Yourself Radio" series would
better than a TRF set which he has
ady built himself.

Without further details of your
such as the number of valves and
e details of the circuit, it is very
icult for us to advise you. There
also the question as to what con-
utes better performance, since some
ple may find a set too difficult to
dle, even though it is capable of
ater sensitivity. However, the recent
probably give as much sensitivity
it would be possible to get from this
bination of valves, and really amazing
formances are possible with sets of
type when they are correctly handled.

I.A. (Boort, Vic.) wants to know
ether the Baby Headphone Portable
(Tex) featured in the February 1947
e of Radio and Hobbies would be
table for use in his location which is
miles from the nearest broadcast
tion.

. There are so many factors which
ern the strength of signals in a
tain location that it is impossible to
definitely whether this set would
satisfactory or not. However, it is
btful whether you will get very
isfactory results using the loop aerial
a better proposition would be a
ilar type of set using a standard
inartz coil. Two such circuits were
"IK5-TWO" (July, 1947) and the
om Thumb" (August, 1947) and copies
these circuits are available through
r postal service.

.W.S. (Geelong, Vic.) is interested in
circuit of a 2 valve amplifier for
with a pickup.

. Possibly the "Baby Record Player"
ich was described in the August, 1950
ue of Radio and Hobbies would suit
purpose you have in mind. It employs
single 6M5 amplifier valve and a 6X4
tifier, and is capable of worthwhile
ults when used with a crystal pick-
We can post a copy of the circuit,
wiring diagram and a list of the
rts direct to you through the 2/- query
vice.

G.M.H. (Russel Island, Q) apparently
nts to build a TRF receiver using dis-
sal valves and requests that we com-
nt on the use of Acorn and type 7193
lves for the RF and audio end re-
ectively.

A. It would be possible to use these
lves as you suggest, though a little
conventional. We would point out
at there are other disposals valves
ich might be more suitable for your
quirements in that they are standard
ceiving types for which replacements
ll be more available. We regret that
are unable to help you in the matter
circuits or other data.

J.W.M. (Amberly, Qld) asks if a broad-
st receiver can be made from a par-
ular piece of aircraft equipment.

A. Sorry, but we do not keep files on
ilitary equipment and do not have any
owledge of the set you mention. If
u care to make a list of the valves
d parts and post it to us through
e 2/- query service, we would be glad
check through our files to see if we
n help you. There is just a possibility
at one of our standard circuits would
near the mark.

R.H.F. (Parirua, NZ) asks us how to
nnect a lightning arrestor.

A. We can't help you unless you are
le to describe the arrestor in some
ay. Your best plan would be to make
rough sketch, showing the terminals,
d post it to us through the 2/- query
rvice. We will then return your sketch,
ith the additional information you re-
ire, by post as soon as possible.

K.J.M. (Tecoma, Vic.) sends us a cir-
it of an amplifier which he has used
tensively for talkie and PA work and
hich he thinks may be of interest to
her readers.

A. Many thanks for the circuit and
mments K.J.M., and we will note the
rcuit for possible use in the "Reader
uilt It" column. The circuit appears
be fairly conventional but the phase
verter circuit may be of interest to
aders as well as the connections for
e photo cell.

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WANTED TO BUY SELL OR EXCHANGE

FOR SALE: TA.12.D. Transmitter in original condition, £20. 1155 Ex-RAF communications receiver with built-in power pack and 6V6 output, bargain £25. VK.3.AOD, 190 Latrobe St., Warragul, Vic.

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FOR SALE: Caxton's modern Practical Radio and Television (3 vols.). Brand new, £4/10/-. J. Colley, 215 Pacific Highway, Hornsby.

SELL: Pioneer Genemotor 220v-6v £5. Magnetic Pickup £3 or offer. Lot 13, Flowerdale Rd., Liverpool.

SELL or Exchange: "Headmaster" P.U., 4 Heads, "Collaro" Type AC47 Motor. Ayre, 65 Kinmore St., Melb., 12. WX4767.

SELL: Portable 240 A.C. Crescent Wire Recorder. Bought U.S. '51, and 30 1 hr, reels. Records voice and radio plays and records discs; hi-lo output for Hi-fi amp; New U.S. head Jan. 7-valves, excel. condt. Inspection Sydnev mid-May. **Fr. Corcoran, Presbytery, Wellington, NSW.**

SELL: 2in oscilloscope, valve and circuit tester, and modulated oscillator, £75, or sell separately. S. Hutchinson, 46 Bruce Street, Stanmore (LM7946).

WANTED: Quantity small magnifying lens, ½in to ⅝in diam. Waite, Windsor Rd., Northbridge.

WANTED: Coil boxes D & E for AR7 RAAF receiver. A. A. Marks, 543 Port Road, West Croydon, Sth. Aus.

WANTED: 16in acetate cutter urgently required by Christian broadcasters ("Sunshine Hour"), motor, traversing gear and head only; loan, hire, or purchase. **Rev. Turner, Box 4669 GPO, Sydney, or care MA7753.**

EXCHANGE: R & H's, 1939-1951, in attractive covers for old boxing mags., boxing record books, etc. H. Clements, 310 George St., Sydney. BW2715.

Cost of Classified advertisements in this section is 2/- per line; approximately five words to a line. Closing date for June issue of Radio and Hobbies is Wednesday, May 13th.

A TWO VALVE REACTION SET

(Continued from Page 55)

winding, starting the winding about 1-16th inch away from it. You may need some help to hold the wire while you drill another hole through which the top of this new winding will pass down to pin 6 to form the grid connection.

The reaction winding goes above this again, being spaced about 1-8th inch away and wound on in the same direction with 32 B & S enamel. The lower end of the reaction winding connects through pin 2 to plate, while the top end connects through pin 1 to the reaction condenser.

We may be able next month to have a little more to say about winding coils, but the above will give you something to work on.

For the short-wave coil wind on five turns of about 24 gauge wire for the grid winding but placed fairly close to the bottom of the former and spaced to occupy an overall length of about half an inch.

The aerial primary winding consists of two turns of 32 gauge actually interwound with the bottom turns of the grid winding. Connections are the same as for the broadcast coil, however. Bottom of both windings goes to earth, top of the primary goes to aerial and top of the larger winding goes to grid.

The reaction winding, still wound in the same direction, is spaced about 1-8th inch above the grid winding and comprises five turne of 32 gauge. Bottom of the reaction winding connects through to the detector plate, while top of the winding goes to reaction condenser.

You will find that this coil covers the frequency range between 7 and 21 Mc.

It can be wound either on a commercial 1¼-inch diameter former or on a discarded six-pin valve base, having the same dimensions.

A SIMPLE 3-BAND OSCILLATOR

(Continued from page 65)

any receiver will produce if subject to a reasonably strong signal. This will be removed from the true signal by twice the IF, which is not very far on a short-wave dial, and it can cause serious error if it is used in place of the true signal. In all normal superhets, the true signal will be the one which is higher in frequency.

A purely physical problem which presents itself in a job of this kind is that of marking the scale behind the cursor when the latter has been set to a particular calibration point. Normally, there is not enough space between the cursor and the scale to allow a pencil to be inserted, and, if the space is widened, it is extremely difficult to avoid serious parallax errors.

One way of overcoming this is to equip the knob with an offset cursor. This is a cursor which has been cut down the centre line so that one edge of it is actually on the centre line, thus serving as a straight-edge to mark in the calibration points. This cursor may be retained for normal work or, when the calibration is complete, it may be replaced with a more conventional type.

Another approach is to drill or punch several small holes in the cursor, one for each band to be calibrated, each being on the centre line and over the dividing line between the bands on the scale. These holes allow a sharp point, such as a pin or needle, to be used to lightly mark the scale in line with the cursor centre line, after which the cursor is moved to one side and the mark identified.

This description is necessarily brief and those readers who feel that they would like a little more information on the subject are reminded that there is a pamphlet available through our query service entitled Calibrating a Service Oscillator. Price 1/-.

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